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The Successful Control of Profits

By

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Preface

EVERY TYRO knows what a cost is, and yet, what crimes are committed in its name! Cost is assumed, and rightly so, as the basis of profit, and every vendor believes he knows his cost, and consequently sells his product with surprising boldness. As one grows old in industry, he becomes aware that a true cost, under the varying conditions of trade, is almost as rare as the dodo.

Undoubtedly, mistaken policies are responsible for most failures, and he who has conducted autopsies finds that usually the patient has died of a complication of diseases, but that almost invariably a substantial contributor to the demise is the absence of a competent cost system and its attendant adequate method of cost control. The last decade has seen a marked increase in the number and in the influence of Trade Associations. With hardly an exception, the first step on the part of an alert Trade Association is the installation of a uniform and thoroughly efficient cost system. The tonic effects are immediate. False profits based on false costs vanish, and the competition, while perhaps no less keen, becomes healthier, because each competitor is fully acquainted with the effect upon his profits of the selling price he quotes.

Blessed, then, be the man who makes a true cost grow where one has not existed before, and blessed be the authority who plants the seed — this Professor Rau-

tenstrauch has done in his book "Successful Control of Profits." In simple, lucid style he analyses the bases of true costs and builds therefrom a comprehensive system of cost control, including methods of budgeting, which is altogether admirable. His graphic processes, and particularly his Break-Even Chart with its elaborations, are significantly interesting in their originality.

A business without profit is a sterile, useless encumbrance, and Professor Rautenstrauch is careful to point out always the necessity for profits and to emphasize the means of securing them. He does this so ably that I am persuaded he may well be called a Prophet of Profits.

WILLIAM C. DICKERMAN,
President,
American Locomotive Company.

January 20, 1930.

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INTRODUCTION

THE large number of business enterprises which fail each year is convincing proof of the need of a better understanding of economic principles on the part of those who attempt to direct their operations. Many enterprises are started which should never have been begun because they contain some fundamental economic weaknesses. Others, after some years of operation, are finally closed down or have to be reorganized because of the adoption of policies which are out of harmony with the conditions to be met.

A prudent person would never set sail in a leaky boat nor allow his goods to be carried in a ship the captain of which is not an experienced navigator. The amount of money which is lost in poorly conceived manufacturing enterprises and in badly managed businesses seems to indicate that the same evidence of security is not demanded in these as in other undertakings. An electrical engineer in charge of an electric generating station controls the operations of his machines through a knowledge of their characteristics. So also a steam engineer, through his knowledge of the operating characteristics of the several units under his control, adapts them to the load changes on the plant in order to effect the maximum economy of operation. The structural engineer designs the bridge for minimum weight, to carry a given load, through his knowledge of loads, na-

ture of supports, stress-strain characteristics of the materials used, and the mechanics of structures.

Each field of engineering practice is founded upon certain laws and principles which must be thoroughly understood before one may successfully engage therein. The electrical engineer does not consider himself competent to design the structure, nor does the structural engineer attempt to operate either the electrical or steam machinery. This is due to the fact that each field has developed its own science and it is generally recognized that special training and experience are required for the particular work to be done. Some men, of course, are capable of acquiring expertness in several related fields of engineering, and thus are capable of dealing with a wide range of problems. In the field of business enterprise, however, particularly in manufacturing in which so many complex problems must be dealt with, there seem to be no well-established standards of attainment demanded of those who operate them. This is perhaps due to two causes: *First* it is not generally recognized that business enterprises may be subjected to scientific analysis, and *Second* the exploitation of our enormous natural resources by untrained men has raised these men by their economic good fortune to high esteem as captains of industry, and their economic success seems to deny the need of scientific training for a successful career in business.

There are, of course, many economic principles which have been formulated and applied to many conditions in business, but at the same time it is apparent that there does not exist in the field of business any body of

laws and principles similar to that which guides the engineer in his work from designing the machine or power plant to the final acceptance test by the customer.

The conditions which the engineer must meet, however, are quite different than those which confront the business man. If he is designing a structure, for example, he is quite sure of the loads which are to be imposed, or if he is building a power house the operating conditions to be met are quite clearly defined. But what business man can tell how much he will sell in a given period or when a labor strike or patent suit may have to be dealt with, or the extent to which credit stringency or competition may affect his business at any time? Yet if business is to survive it must be prepared to meet any one or several of these conditions as well as many others.

One of the most important steps to take in organizing and managing a business is to eliminate the " element of surprise." It is apparent that all business operations cannot be guided with mathematical precision. What may be termed the " normal factors " of a business, however, may be readily formulated and set in relation to each other so that one may see, in general, the effect which is had on the business as a whole, or in any particular, upon a change in this or that factor. A manufacturer knows, in general, that as the output of a plant approaches the capacity of the plant, that is, the more goods produced in a given time, the lower the unit cost of the product. Not many are able to state, however, that at a given selling price, cost of raw materials and labor, the plant must be run at a given capacity in order

to break even; that is, that there is neither a profit nor a loss. Again, although the business, as a whole, may be profitable and several varieties of products be sold, are all products equally profitable to handle? are some sold at a loss? are others priced too high? If a 10 per cent wage increase is granted, how much more business must be done to make the same profit as before? If the plant is enlarged, with a consequent increase in fixed charges, how much more goods must be sold to warrant this expansion?

These questions and a host of others arise in many businesses and may readily be answered if a proper analysis of the characteristics of the business has been made and the results thereof properly formulated. There must be facts and *relationship* from which to orient a sound policy if the business is to be guided successfully and not just happen to be successful. Business, of course, is always a venture and is continually subjected to hazards.

Business enterprise for a long time was largely concerned with buying and selling, and fortunes were governed by the classical law of supply and demand combined with shrewd bargaining. Modern quantity production methods have shown that demand is governed by price. Ford cars produced at the rate of 1,000 per month could not be sold at half their cost of production for there would be no demand for them at that price. When produced at the rate of 7,500 per day, they can be sold at a profit because the purchasing public demands that number of cars per day *at that price*. Accordingly, therefore, the conditions governing the cost

of manufacturing goods at varying rates of production by competitive methods of manufacture are controlling factors in modern business enterprise.

Quantity production methods must be supported by quantity selling methods. Markets must be found *and kept*. The most economical methods of merchandising must be employed. Credit collapses, crop failures, and other disasters affecting the general purchasing power lower the price level at which goods can be moved and the problem of stagnant inventory arises. *Modern scientific research is a constant hazard to funds invested in productive enterprises.*

The business of manufacturing and merchandising goods today is a complex problem and demands a higher degree of talent on the part of those who engage therein than in times past. Experience has shown that there are certain basic laws which govern the various phases of business enterprise and these fall into two general groups: production and merchandising. It is the endeavor of this text to set forth some of the basic economic principles underlying modern business enterprise.

Unfortunately, the work of the economist has dealt more with the problems of barter and trade than with the problems of production, and the results of this work are more useful in dealing with broad economic situations than in solving the problems of a particular industry. By following the analysis of the economist, the manufacturer may learn of the hazards to business in general. This is important. But the manufacturer must know the characteristics of *his* business in order to take advantage of the conditions which the general eco-

nomic factors forecast. The Bureau of Navigation may send out storm warnings but it takes good seamanship and an intimate knowledge of the vessel handled to save it.

It must also be borne in mind that the ability to purchase depends upon two factors: income of purchasers, and the price of the things to be purchased.

It was a long time before the manufacturer realized that the people who made his goods also purchased his goods — that a high-wage rate will move the product. Those countries which have a high-wage rate are the most prosperous because a high wage creates purchasing power.

Prosperity means a high rate of consumption of natural resources. Prosperity and consumption of resources are synonymous terms.

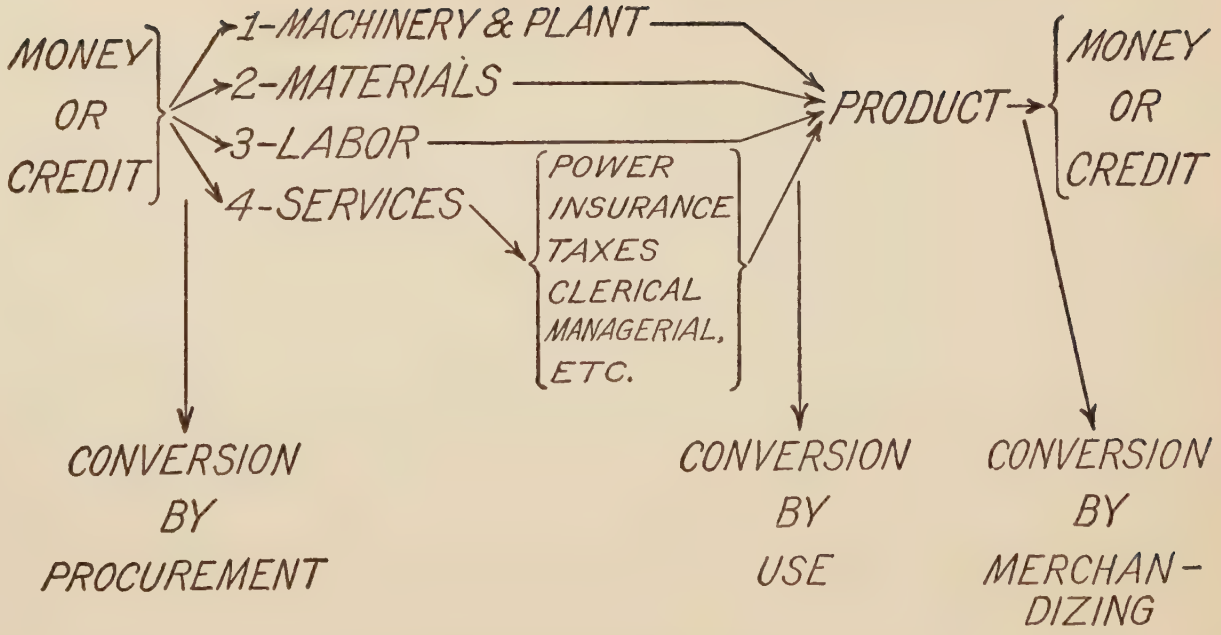
Prosperity wanes when natural resources are depleted, hence the value of research which develops new resources, and creates more economic uses of those now available. A rajah of India has enormous purchasing power but he would rather possess the elephant caught in the jungle than an engineer's level. Modern business procedure, therefore, must be based on the laws of economic production and the laws of purchasing power based on the desire to possess.

THE AUTHOR

January 15, 1930.

CHAPTER I

BUSINESS IN GENERAL



THE ECONOMIC CYCLE

FIG. 1. THE ECONOMIC CYCLE IN A MANUFACTURING INDUSTRY

The Successful Control of Profits

CHAPTER I

BUSINESS IN GENERAL

IT is always helpful in making a study of a particular business to survey the general field in which the problems to be considered arise. Facts and relationships may then be set in proper perspective. In considering certain of the economic aspects of business enterprise involving manufacture, it is necessary to acquire an understanding of the successive events in manufacturing and merchandising which have an effect in changing the value of things. Business in some respects consists of taking things of one value and changing them to other values. The conduct of a business consists in controlling value changes. The succession of value-changing events may be termed the "economic cycle."

The Economic Cycle

A general survey of what may be termed the "economic cycle" of a manufacturing enterprise may be had by referring to Fig. 1.

This diagram suggests that enterprises are founded upon *money* or *credit*. The first problem, which it is beyond the scope of this book to consider, arises at this point. The terms of financing an enterprise may have much to do with the fixed capital charges under which the enterprise must labor. The elements of failure may be established at this time before the project gets under way.

Conversion by Procurement

Assuming, however, that adequate funds are available upon terms which are not hazardous, the first phase of the cycle consists in *conversion by procurement*. There are, in general, four elements to this phase, that is, money or credit is used for four primary purposes.

1. It is used for the *purchase of machinery and the property of the plant* by means of which productive operations may be conducted.

2. It is used for the *purchase of raw materials* for manufacturing the product.

3. It is used for *payment to labor* which is engaged in converting the raw material by the use of machinery and plant into the finished product.

4. It is used to *provide services* necessary to the conduct of manufacturing operations, such as power, heat and light, fire protection through insurance, taxes, supervision, clerical service, etc.

The economic conversion of money or credit into these four essential factors in manufacturing is of the utmost importance in order that goods may be pro-

duced at competitive costs. Any lack of skill on the part of those charged with these responsibilities is the first step in the establishment of waste in manufacture. In respect of each of these elements it may be stated:

First, the procurement of machinery and plant. The effectiveness of this operation establishes certain organic features of the business. Machinery ill adapted to its purpose may involve high labor cost and a poorly laid out plant will establish costs which are not always found in the operating statement. Costs of operation occasioned by the inefficient conversion of money into machinery and plant are of the most dangerous character because they do not evidence themselves readily. It would be helpful to have these costs segregated in such a manner that they would have to be met by the management each week just the same as the payroll is met. One reason why wage payment to labor has received so much attention is that the management must provide the cash each week to meet it. A workman who does not do his work well is laid off because his case comes up regularly each Friday night, but the poor equipment all too frequently escapes notice because there is no regular routine provided for paying the bills it incurs.

The purchase of machinery and plant is a matter of constant concern. Improvements are being made each year, and no manufacturer can afford to neglect the study of new equipment available. At this writing there is much interest in a new material for metal cutting tools which bids fair to make obsolete many kinds of machine tools on the market today.

The problem also arises as to the amount of productive capacity to be purchased in relation to the probable market for the product. In a period of expansion there is a general tendency to purchase too much machinery and plant, in relation to future requirements resulting in capital being fixed at a time when there is need of liquid capital.

Second, the purchase of the raw materials of which the product is to be made. If material is defective the cost as finally assembled in the product may be high due to scrap or high labor costs in processing, and high labor costs of inspection. *A low-unit purchase price does not necessarily mean a low material cost of the product.* Purchase with respect to market and times may be of the utmost importance in some industries. This is particularly true in flour milling, sugar production, and cotton goods manufacture. Hedging the market against future commitments is a regular practice in those industries in which raw-material costs are the chief costs of the finished product, and in which prices fluctuate over a wide range compared to production costs. It may cost $\frac{1}{2}$ cent per pound to convert raw sugar into granulated sugar but during the time of manufacture the price of raw sugar may fluctuate beyond this range. In such an industry, the efficiency of the conversion of money or credit into raw material is of the utmost importance. On the other hand, the cost of raw material for a surveyor's transit is about 8 per cent of the cost of manufacture and consequently the purchasing division of this business does not command much of the management's attention.

The problem also arises as to the quantity of material to purchase in relation to the quantity and time of delivery of merchandise. *The shortest time of investment between the purchase of materials and the delivery of the finished product establishes an effective capital turnover,* and therefore contributes to the efficiency of conversion at this point of the cycle.

Third, wage payment to labor may or may not be commensurate with the work done or service rendered and, therefore, this element of the phase may or may not be efficient. Piece-work systems, bonus wage-payment plans, and devices of a similar nature are usually effective in producing a low labor cost per unit of product together with a high wage return to the worker. Unless some plan of wage payment which relates wages paid to work done is adopted, the situation becomes quite similar to my ordering from the grocer any basket of apples and sending him any check. With such indefinite instructions, the size of the basket and the quality of the apples will probably dissatisfy me and the check the grocer gets will not be according to his expectations. Not so long ago, all labor was hired on just such a principle.

Fourth, the payment for services may be of the greatest significance. Excess taxes may demand relocation of plant. High-insurance costs may be caused by processes of high risk being housed in the midst of the plant instead of segregated. Materials handling may involve too much clerical labor due to poor stores location, and poor production planning. Money inefficiently spent for materials and supplies and inefficient help will nar-

row the margin of profit and may be a principal element in the failure of an enterprise.

The few examples given are sufficient to indicate that the efficiency of conversion by procurement is of major importance in the whole economic cycle of manufacture.

Conversion by Use

The next phase of the cycle may be termed " conversion by use." The functioning of machinery, materials, labor, and services results in the creation of the product. The efficiency of this phase of the economic cycle will be conditioned by many factors but, in general, it will be dependent upon the planning and execution of the production program.

The whole object of planning production is to accomplish the quickest turnover of working capital.

A well-conceived and executed production program will result in the minimum time of investment in raw material and labor. This means that inventory of raw materials, work in process, and finished goods will be at a minimum.

Conversion by Merchandising

The next and final phase of the cycle is *conversion by merchandising*. The importance of this function will be great or small, depending upon the nature of the product. If, for example, the product is a highly competitive standard one, such as cigarettes, or breakfast food, or chewing gum, then this function may depend

upon the clever use of a trick phrase such as "Not a cough in a carload," and an extensive billboard- and newspaper-advertising campaign creating consumer demand.

On the other hand, the selling of electric mine hoists may depend first on a high quality of product and second on excellent engineering salesmanship involving a high degree of technical skill. The advertising of mine hoists in *The Farm Journal* could not be considered a wise use of funds.

In general, the effectiveness of this phase of the business will depend upon the amount of study and energy intelligently employed in studying markets. The battle ground of business seems to be drifting to the market place.

Conversion by merchandising results in money or credit. A poor credit policy may destroy the whole program. Unfortunately, the American manufacturer acts too often as the banker for his customers, and much of the working capital of a business is represented in open accounts of undue proportions. The use of trade acceptances by which the banker could take his legitimate place in the cycle of transactions would overcome much of this difficulty. It appears that European manufacturers do much more business with the same amount of working capital, through the use of the trade acceptance.

It may be helpful to view the above problem from the standpoint of the illustration given in Fig. 2. All materials, services, etc., to be procured may be considered to

stand at some average level *A*. The cost of procurement by the manufacturer will raise the average value to some level *B*. Depending upon the efficiency of conversion by use, the value level is raised to some point *C*. The cost of merchandising the product will raise it to the value *D*. If now the product may be sold at the level *E*, a profit will result.

Consider, however, the number of decisions which must be made which will effect these different value levels. As a general rule, in a competitive market the levels *A* and *E* are fixed within a narrow range of values. The purchase and use of poor equipment will raise both *B* and *C*. The purchase and use of poor materials will raise both *B* and *C* and may raise *D*, since greater selling effort may be required for a poor product. It is apparent that an accumulation of poor decisions may wipe out the margin of profit. A highly competent personnel may overcome the handicap of an incompetent board of directors, or a very competent board of directors may be ineffective because of an incompetent personnel. The decisions of subordinates are frequently of great influence in the success of a business.

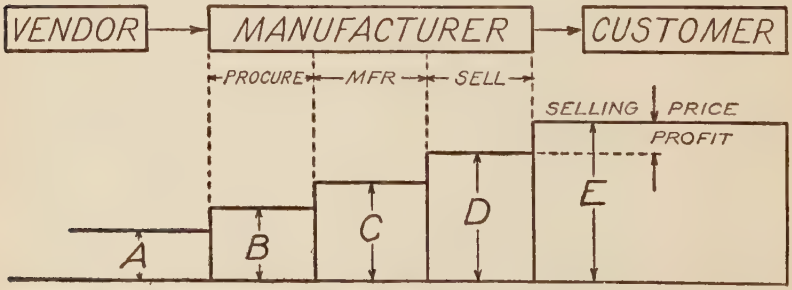


Fig. 2. An Example of Costs and Profits in Manufacturing

It must always be remembered that *the margin between success and failure is very narrow.*

Consider, for example, the illustration in Fig. 3 which represents the relation of cost and the elements thereof, to profit in the book manufacturing business. The cost elements are averages obtained from cost records. It will appear at once that not many errors in judgment at *A* or *B* or *C* or *D* or *E* will be required to eliminate the narrow margin of profit.

This brief examination of the economic cycle shows that a multitude of transformations of value are accomplished in the conversion of money into raw materials, machinery, labor and services, into products, and again into money. Modern industrial development in the matter of better tools, more efficient labor, and more skilful management permits these transformations in values in the economic cycle to become more and more efficient, with the general result that the several price levels tend to become lower and lower and the total volume of business tends to increase. Accordingly it would appear

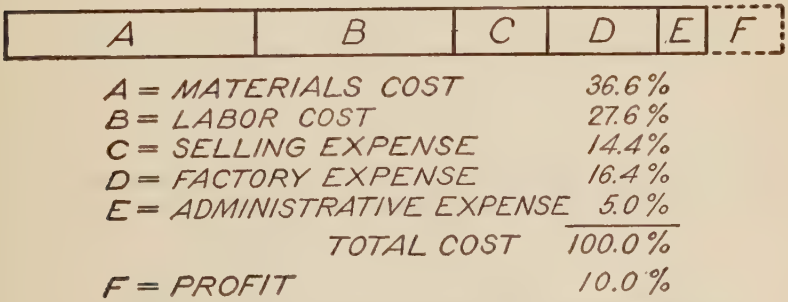


FIG. 3. THE COST INCREMENTS FROM RAW MATERIAL TO FINISHED PRODUCT

that the four major factors effecting industrial prosperity in general are:

1. The price level at which raw materials are procured.
2. The price level at which the products of manufacture leave the factory.
3. The price level at which the goods are sold.
4. The number of units produced in a given time period.

These factors bear an intimate relation to each other and are interdependent. The price level at which raw materials are procured is dependent, in general, upon the quantity purchased. In any given case it is also dependent upon the proximity of materials supply to factory location, and upon inbound transportation and handling charges. *The purchase of raw materials in quantity permits the raw materials producer to adopt quantity production methods and thus all the users of such materials can procure at lower price levels.* Sheet steel, castings, bar stock, cloth, and other products which are the finished products of some manufacturers are the raw materials of other manufacturers. Any general increase in demand for these materials due to a high rate of consumption of finished goods has a tendency to lower their price level. Thus the growth of the automobile business, with its enormous demands for raw materials, has lowered the price level of procurement of these materials to other manufacturers using similar raw materials. The price level at which the products of

manufacture leave the factory is conditioned by the efficiencies of procurement, conversion, and merchandising which were above referred to. These efficiencies are again dependent upon the skill of management and upon the opportunity of management to exercise its skill on quantities of goods. Assuming a given degree of skill, the cost of producing goods decreases with the volume produced according to the general law, Unit cost $= A + \frac{B}{X}$, where A and B are constants for any particular business and X is the quantity of goods produced. This law is developed in Chap. V. Thus again, the price level is seen to be effected by the quantities of goods dealt with.

The price level at which goods are sold is affected by several factors, principal among which are:

1. The number of people who will purchase the goods *at the price offered.*
2. The margin of profit fixed by the above selling price and the price level of finished goods.

The movement of goods at a price is dependent upon the number of people who have sufficient incomes or purchasing power to buy the goods, as well as upon the effectiveness of the merchandising methods used to create the desire to possess and convenient opportunity to acquire. Washing machines selling at $200 have a more limited market than washing machines selling at $100, because there are more people possessed of $100 than there are possessed of $200. However, a *particular* washing machine selling at $200, supported by an effec-

tive advertising and merchandising campaign, *may* sell in larger quantities than another make of washing machine selling at $100, but not supported by advertising and with a poor sales organization to promote it. Assuming, however, that good merchandising methods are used, it is apparent that a product selling at $200 will find a larger market if the price is reduced to $150. Will the increased sales, however, result in a lowering of the price level of finished goods to the point that the *total* profit during a given time period will be greater? Any lowering of the selling price must be justified by an increase in volume of sales sufficient to cause a lowering of the price level of finished goods such that total sales times profit per sales will be greater. The tendency in industry is to provide a volume of sales of 100,000 units per year at a profit of $50 per unit, for example, as compared to annual sales of 10,000 units at a profit of $200 per unit.

The general relation between the above four factors is shown graphically in Fig. 4. In this illustration, it is shown that as the volume of sales advances from *A* to *B* the cost of finished goods tends to decrease. Since the raw materials of one industry are the finished goods of another industry, the cost of raw materials also tends to decrease with increasing volume of sales. Obviously, the selling price tends to decrease, with the consequence that the goods are brought within the range of purchasing power of a larger number of purchasers, which makes the whole program of sales expansion possible.

Competition forces the margin of profit per unit to a lower level but the increase in the number of units on

which a profit is realized tends to increase the total profits as shown. As we examine this whole situation more closely, we find that there are the following fundamental causes for the tendencies shown in Fig. 4. In the first place, volume production permits the specialization of labor so that repetitive tasks may be performed with greater skill and speed. Accordingly, the labor cost per unit of product tends to decline. In the next place, volume production permits the use of special machinery, replacing hand labor and permitting of even greater accuracy and speed of production. In the third place, volume production which permits of specialized

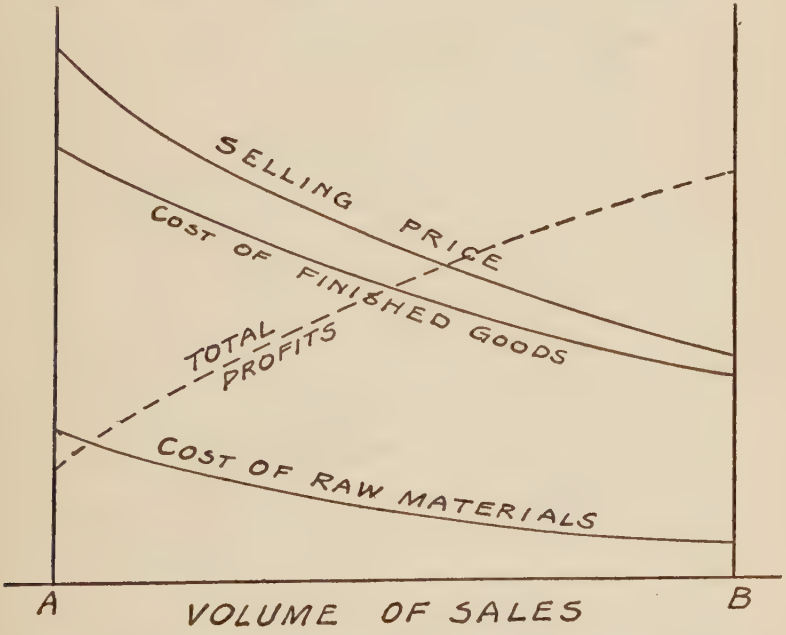


FIG. 4. THE GENERAL RELATION BETWEEN VOLUME OF SALES, COSTS, SELLING PRICE, AND TOTAL PROFIT

labor and specialized machinery also permits of specialized techniques whereby a few highly skilled technicians may set the patterns and simplify operations, and thus enable a large body of unskilled labor to be employed at comparatively high wages. This is perhaps of far greater consequence than most people realize, because *it is the high wage paid to unskilled labor which has created the great purchasing power which makes volume production possible.* In the fourth place, the specializations above referred to also permit of simplifications in management. The service functions in management have been subjected to the same refinement, with resulting economies which were found so effective in the productive or operating divisions, whereby the service costs per unit of product are materially reduced.

The general consequences of modern industry in our economic life are indicated graphically in Fig. 5. Let us assume that a few years ago the total purchasing power of the nation was as represented by the line AC to the left in Fig. 5. This purchasing power is devoted to the acquisition of the necessities (of that time) AB and the luxuries (then available) BC. The general advances in science and technology have resulted in the creation of more efficient tools, new kinds of tools, and new processes. Labor has become more skilled in the use of the new equipment and management has improved. The result is that labor receives a higher wage and the cost per unit of product of both necessities and luxuries is decreased. Accordingly, we find our present-day purchasing power as $A' C''$ as shown to the right of

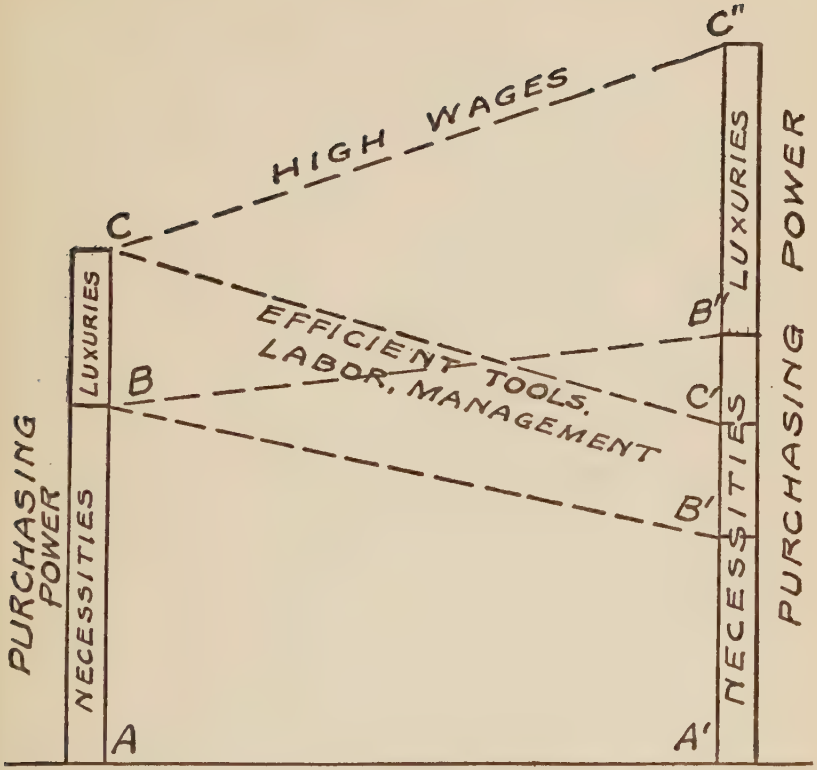


FIG. 5. THE GENERAL EFFECT OF INCREASE IN INDUSTRIAL EFFICIENCY ON WAGES AND PURCHASING POWER

Fig. 5, and the cost of the necessities and luxuries of former years are now $A'B'$ and $B'C'$. But we also find what may be termed a " psychological change " in that the luxuries of former years have become part of the necessities of the present day. Most significant of all, however, is the fact that the present higher wages, together with the lower cost of former necessities and luxuries, make available a purchasing power $C'C''$ which may be absorbed by new commodities. It is this new purchasing power available which is the fire under the boiler of modern economic life. For this reason, a new industry, such as the radio industry, can grow to the proportion of $500,000,000 annual sales within a period of a few years. Another factor has recently entered our economic world and greatly influenced the credit system upon which purchasing power is founded, and that factor is the Installment Purchasing Plan, or Deferred Credit Purchasing Plan. By means of this powerful instrument, the capacity of the average citizen to acquire worldly goods has been materially increased and consequently the demand put upon the producer for quantity production has been much greater than would arise normally from the payment of higher wages alone. While the installment purchasing plan is not new, for it has been in use many years in a restricted way, it has been given great importance in our economic life through its use by automobile and household products manufacturers. It is estimated that at least $6,000,000,000 credit is now in force by the use of this plan. The question may properly be raised as to whether or not installment purchases will continue to have as marked an effect

on future production as in the past, and also, will there not come a time when the obligations to be met due to past purchases will balance the ability to buy on future or deferred payments, and thus purchasing power will cease to increase as rapidly as in the past. How much outstanding commercial paper of this character in relation to the annual income of the individual using this plan of purchasing constitutes a hazard to our credit structure in times of depression or excessive unemployment? So far we have gone along quite well, but, since it is a new element in our economic life, no one would be criticized for carefully observing its effects in the future.

CHAPTER II

BUSINESS IN PARTICULAR

CHAPTER II

BUSINESS IN PARTICULAR

WHILE the general economic conditions in force during a given period of time will militate for or against the prosperity of business as a whole and thus influence all business enterprises, the success of any particular business enterprise is conditioned at all times by the extent to which each element thereof is functioning in harmony with basic economic principles. Accordingly, the relationship of any given business to economic life in general is a matter of importance to the success of that particular enterprise. Because business conditions in general are good, all businesses are not equally prosperous — some may even experience failure — why? A company with a business experience of thirty years is closing its doors while its neighbor across the street, only two years old, is making a handsome profit — why?

What are the elements of failure inherent to the one and the elements of success inherent to the other? Difference in management? Maybe — maybe not. A poor captain may navigate an unseaworthy boat in a calm sea and bring a valuable cargo to port, while an excellent captain may come to grief in a seaworthy boat on a stormy sea.

Satisfying an Economic Want

Any business to justify its place in the economic world must satisfy an economic want. Now this raises two questions: What is the want and what is it that satisfies the want? And in many cases it might be profitable to ask, How long will it be wanted? A business may be satisfying an economic want today which ceases to be a want tomorrow. Embroidery, ribbons, hairnets, harness, buggies, hatpins, and hosts of other products which were in demand a few years ago are no longer generally wanted today. Manufacturers of these products who read the signs of changing times converted their factories to the production of commodities demanded by the newer generation, or sold their businesses to less alert minds and invested their capital in other enterprises. The Studebaker of the past generation manufactured wagons; the Studebakers of the present generation manufacture automobiles.

A product satisfies an economic want when:

1. It is a factor in the life habits of the community.
2. It is preferred over alternate products because of quality at a price.

The late Prof. John E. Sweet, of Cornell University, was once shown a machine invented by a young man to accomplish a certain operation. After looking it over carefully, he remarked, " This is an excellent method for doing something that nobody wants done."

Typewriters in India are as useful as the proverbial

fur coat is to the Hottentot, yet 50 per cent of a certain lock manufacturer's products are sold in India because the people there are accustomed to carrying their possessions in padlocked baskets.

Changes in Economic Wants

Scarcely any manufacturing industry exists which is not subject to style changes. In some, the change is very gradual, in others, quite rapid. There is scarcely any change in rolled steel shapes, sheets and bar stock, nor in cement and products of similar character, as far as the products themselves are concerned, though the process of manufacture may change naturally. But the manufacturer of battery radios, in 1927, was compelled to manufacture, in 1928, all electric radios directly attachable to power lines — a wholly different product in every respect.

Between these two extremes we note varying degrees of rates of change in what is desired by the purchasing public. A product may be of a class that is wanted but the desires of the public in the matter of quality and price may be quite apart from that which is offered. Henry Ford created the low-priced automobile and his Model T had an enormous sale, as everyone knows. But then came a time when competition forced a change, not in price but in quality. The public began to prefer other low-priced cars of different quality. A few years ago all laundry soap was sold in bar form. A certain teacher of domestic science suggested to one soap manufacturer that soap in the form of flakes would be more service-

able, but she was told that such a product would not sell. Today most laundry soap is of this form and the first producer of the new product even now retains the lead over his competitors who were forced to follow his example. A patent was recently obtained on a design of soft collars for men and was offered to a certain collar manufacturer for what now seems a ridiculously small figure. The offer was not accepted because the manufacturer felt that such collars were not marketable. This particular collar manufacturer is not in business today. The inventor of the new collar made a deal with others and is now very wealthy.

The Importance of Design of Product

Many companies at the present time are so intent on high-pressure selling methods and the merchandising problems of the business that *altogether too little attention proportionately is being paid to the problem of the design of the product.*

Those concerns in which the design function is given its proper place in the operations of the business have a better chance of sustained success than those which neglect this side of the business. The operating head of the business is generally responsible for the extent to which the design of the products receives proper attention, and therefore he should have some production or designing experience in order to appreciate these problems. If Henry Ford had not given his personal attention to the design of the new model Ford, the results might have been quite different. Even food products,

textiles, and similar products must be properly designed in order to gain public acceptance. The specification of the qualities to be attained in a commercial food product and of the operations by means of which they are to be attained, both of which are design problems, are of prime importance to the success of the business. The baker and the canner must design their products properly in order to produce a satisfactory quality at an acceptable price, just as much as the auto manufacturer must design his products with regard to the same ultimate result.

Designing is a continuous process because as civilization develops, newer wants are created, life habits change, and products to meet these needs must also change. Rugs replace carpets in the home, the radio is preferred to the phonograph for musical entertainment, foods must have vitamins as well as calory values, the turbine replaces the reciprocating engine, steam pipes must carry a higher pressure, quick-drying lacquers replace slow-drying paints, milk must have a limited bacteria count, and so on in endless variety.

The Design of Processes

The product desired with respect to quality and price cannot be attained unless the processes of manufacture are adaptable to the results required. Accordingly, therefore, *the second essential element in the success of any particular manufacturing enterprise is adequate manufacturing processes.* The rapid development of new machinery, new processes, and modern necessities

of all sorts in the matter of materials, methods, and equipments forces the manufacturer of any commodity to a continuous revision of his manufacturing processes. When Charles M. Schwab built one of the Carnegie steel plants he advised Mr. Carnegie of its completion and invited his inspection. Mr. Carnegie, after going through the new plant, asked if this was now the last word in steel manufacture. Mr. Schwab replied " No," for since the designs had been made, better and more economical methods and machines had been perfected. Mr. Carnegie replied, " Tear this down and rebuild it to conform to the best." This policy enabled Mr. Carnegie to dominate the steel business. Most manufacturers have not the financial resources to carry out such a drastic move, nor indeed do circumstances often warrant such a policy. We recognize, however, many cases where failing to conform to modern methods of manufacture as they are gradually made available and could readily be acquired has caused many businesses to decline and give way to others who were more alert to the advantages of the newer and better methods available. Machine processes are constantly replacing hand processes, to the improvement of both quality and cost of product. Machine molding replaces hand molding; the single-spindle drill is replaced by the multiple-spindle drill and the drill jig; the drive screw replaces the bolt and nut; the conveyor replaces the hand truck; chromium plating replaces nickel plating; and so on in never ending succession better and more economical methods of manufacture are daily made available. In some industries, the improvements appear quite gradually; in

other industries, they may be so sudden and so drastic as to be revolutionary. Flour mills, sugar mills, shoe factories, cotton mills, steel-rolling mills, with the exception of sheet mills, are not much different than they were a few years ago. Improvements in these industries have been quite gradual and machinery and equipment are readily adaptable to modern techniques and scientific control of processes. Chemical industries and industries founded upon biological processes have suffered the greatest changes in manufacturing methods and machines. Light- and medium-metal working plants are perhaps next in order of improvement. Keeping up with improved methods of manufacture is largely the result of a proper attitude of mind. Machinery and equipment used to be, and, all too frequently even now, is considered good because it is in a fine state of preservation, functions properly, and works as well as it always did. The manufacturer needs to realize that in many cases it would pay to get rid of the supposedly good equipment to obtain machinery better adapted to quality and quantity production. The reason why many factories more recently constructed are more successful than some of the older concerns is because of the more modern equipment provided. The knitting industry today is suffering from just this sort of condition. The machines of this industry, while in some cases only a few years old, are no longer economical to use. The test of goodness of a machine must not be mechanical, it must be judged from an economic basis. This sort of test, combined with a little courage, would work wonders in many industries.

The Research Type of Mind

The capacity to be alert to both the design of products and to the specification of processes of manufacture whereby a product which is wanted is created, is associated with the research type of mind. Now let us not hastily judge this word "research." We use it in the sense of openmindedness as opposed to the closed mind, in the sense of courage to work out new ideas as opposed to the fear of venturing into new fields. A young man used to learn a business and make his living by practicing what he learned, but today the young man entering business must not only learn certain practices commonly accepted in business but must also acquire a capacity to adapt himself to economic and social changes, learn new ways, seek new ideas, and even desire and continue to learn.

A business organization has character in much the same sense that an individual has character. It has attitudes toward situations and reacts to environments about as an individual does. These characteristics it acquires very largely from its directing head. Accordingly therefore, in the last analysis, whether or not a company is going to be able to continue to produce an article which the public wants at the quality and price which will attract volume of sales will depend upon the quality of its designs, both of products and processes, and these can only be assured by a management whose head is possessed of the research type of mind. He may never have attended college; he may never have seen a research laboratory, in the technical sense, but every

department of his business will be a veritable research laboratory where the best in methods and means is continually sought out and adopted.

Productive Capacity

The relation of any plant to the productive capacity of the industry as a whole bears a very important reference to the possibility of success of any given enterprise. A business may increase its sales in one of two ways, or in both — either by an increase in public consumption or by taking the business away from competitors. When expansion of an industry is due to an increase in public consumption, a generally healthy condition prevails for every unit in the industry. When, however, a particularly aggressive unit expands at the expense of other units, and new units enter the industry for one reason or another, when the general increase in demand does not warrant additional productive capacity, an unhealthy situation prevails, which results in two things. There is a lowering of selling prices due to the increased competition, and also a higher fixed charge due to an excess of invested capital above plant capacity required and utilized. A third element also appears which lowers the profits and that is the increase in selling effort, with its consequent higher costs. The margin of profits declines and unless the demands of the purchasing public increase to an amount which eventually utilizes the additional productive capacity created, the weaker units in the industry will suffer. The same situation prevails when changes in public demand decrease sales in a given

industry. This situation prevails in certain industries today, notably in certain classes of silk goods which have been supplanted by rayon fabrics. While it may seem like a heartless and drastic measure to take, yet it would be beneficial to each surviving unit, to close down and dismantle a number of units sufficient to balance productive capacity with demand.

The above conditions are particularly marked where the industry is made up of a large number of comparatively small units. When, however, there are one or more predominant units in the industry, there is a general tendency for prices to be maintained and the effect of overproductive capacity is not so marked. The cotton mills of this country do not have any predominant unit among them, while the steel industry has, and the difference in earnings between these two industries is quite marked. Another factor of importance to any particular industry is the relation of any single customer's demands to total productive capacity. As a general rule, any industry is in a hazardous position when about 25 per cent of its productive capacity is given to the needs of any single customer, for any demand of this customer for price reduction will be liable to affect prices as a whole, whereas any withdrawal of this custom will reduce earnings and may even cause the company to operate at a loss. This matter is dealt with quantatively in Chap. V. Accordingly, the chances of success of any enterprise are intimately related to the relation between the industry's capacity as a whole and general sales demand, the tendency of overproductive capacity to increase or decrease and the relation of any particular

customer's requirements to the productive capacity of the plant. The effect on these influences varies in different industries, according to the relation of fixed charges to total cost. In those industries in which there are heavy investments in machinery and equipment, with resulting high fixed charges, there is less flexibility or capacity to adapt operations successfully to a wide range of productivity, whereas in those industries in which fixed charges are comparatively low and the major items of cost of manufacture are labor and material, there is much more flexibility and a drop in sales demand can be more successfully met. The writer recently examined a plant manufacturing an automobile accessory, which had been very highly mechanized a couple of years ago. Elaborate conveying systems and continuous-process equipment had been installed, greatly increasing plant capacity and effecting economies *when the plant was run at reasonable capacity.*

A drop in sales was experienced, however, and the owners found that they could not make a profit at the capacity utilized, whereas formerly they could operate with a profit with the same output. They found that whereas labor could be laid off in slack times the machines could not. If the plant had been laid out in productive units, any one or more of which could be shut down as sales declined, the results would have been somewhat better.

The Value of Patents

The extent to which patents may play a part in the success of any particular business depends very largely

on the nature of the patents. Many manufacturing concerns have been successfully founded upon basic patents. This is particularly the case in the chemical and electrical industries. However, a patent only gives the privilege of suing or of being sued unless it has been adjudicated in the courts and its validity established. There is serious doubt in the writer's mind as to the value of much of the expensive litigation engaged in, in the defense of patent causes. Some industries have found it very beneficial to pool patents and by a court of arbitration to determine whether or not certain patents should be classified as basic or notable contributions to the art, and any patent so judged could be used by others in the industry upon payment of a reasonable royalty. The automobile industry has been greatly benefited by such an agreement and it is believed that many other associations could profitably adopt a similar policy. Any company depending on patents must have capital resources available to sustain its position and, furthermore, must be so organized that the business of patent litigation does not interfere with the business of manufacturing and merchandising its product, which unfortunately it too often does.

The manufacturer is usually advised of the strong position he holds, but he often finds to his sorrow that it costs a prohibitive amount to prove it. The writer has found that it usually pays to get together with the parties at interest and attempt to effect a reasonable agreement. There are notable exceptions to the possibilities of such negotiations but, at the same time, there

are not so many cases where good common sense in handling such matters will not be effective.

Raw Materials Supply

The relation of any particular industry to its raw materials supply is frequently an important factor in its success or failure. Outside of the control of valuable sources of supply, which only a few industries have, the predominate factor is the cost of transportation and handling. Industrial plant location with reference to source of materials has not received the attention which its importance warrants. Remoteness from supply entails high freight costs and large inventories to insure a steady flow of production and possible losses from deterioration and wastage. It does not promote the rapid turnover of working capital which is a fundamental principle to be adhered to in any manufacturing enterprise. This problem assumes greater importance as the cost of raw materials becomes a greater factor in productive costs.

This problem is, of course, closely related to the problem of location with reference to markets, particularly if the product is bulky. The steel industry, for example, is confronted with the problem of location with reference to coal supply, ore supply, and ultimate market. The cotton industries of New England, originally located there because of cheap water-power supply, are losing their position because of better locations available in the Southern states in the heart of the cotton-producing districts.

Many industries could well afford to consider the effect of their present locations with reference to economy of materials supply, particularly in those cases where new materials resources have recently become available, or where new transportation facilities have affected the costs of transportation in other localities. The development of new inland water routes, now in contemplation by the present administration, may have a marked effect on the economy of plant locations in the future, and may even make desirable the relocation of some existing plants.

The Problem of Expansion

When a particular business adapted to manufacturing a variety of products meets the problem of growth and expansion, it is confronted with a situation requiring serious consideration of basic economic principles. The problems arising are:

1. Shall additional products of the same character be taken on, which can be made by the same type of manufacturing equipment and organization, but which are sold in a different market and by different methods than obtained with the present products?

2. Shall the additional products, although having to be manufactured by different methods and equipment and requiring a different type of producing organization, be of the type which may be sold in the same market, through the same type of distributors and by similar merchandising methods?

3. Shall the business be enlarged to care for the manu-

facture of accessories now purchased for assembly in the product manufactured and sold, when the volume of such accessories reaches a considerable proportion?

In attacking this problem it is to be remembered that profits are dependent upon:

a. The rapidity of turnover of working capital.

b. The efficiencies of conversion.

c. The load factor on fixed capital.

Let us examine these principles for a moment. The manufacturer engages in business with a total capital of $1,000,000, of which $500,000 is invested in plant and equipment (fixed capital) and $500,000 is invested in working capital. His annual sales are $2,000,000 and his net profit is $200,000. His profit as a percentage on sales is 10 per cent. His profit on invested capital is 20 per cent. The turnover of working capital is four times annually. The load factor on fixed capital is 400 per cent and is measured by the ratio of annual sales to fixed capital. The term " load factor " on fixed capital is sometimes referred to in the analysis of financial statements as the vitality of fixed capital.

It will be observed in the first place, that the profits of a business are not measured by the margin on sales but more properly as a percentage of invested capital, because the business is that of using a capital of $1,000,000. In the next place, it will be seen that the profits are directly proportional to the turnover of working capital. And again, it will be noted that profits increase with an increase in load factor on invested capital for, obviously, if a greater investment in machinery and equipment is required for the same annual volume of

sales, all other things being equal, the fixed charges will be higher and the profits less.

If, now, an expansion of the business calls for the use of an additional $100,000 in fixed capital, and an additional $100,000 in working capital, the annual sales would needs be $2,400,000 at 10 per cent profit on sales if the same percentage of profit on invested capital ($1,200,000) is to be realized. The annual turnover of working capital ($600,000) would be 400 per cent and the load factor in fixed capital would also be 400 per cent as before. But an increase of $400,000 in business must be examined from the standpoint of its effect on manufacturing cost and merchandising cost before we can assume that a 10 per cent profit on sales is realized on the new business.

The efficiencies of conversion in procurement, production, and merchandising, as shown in Chap. I, control the cost level of goods produced and delivered and, hence, directly influence the margin of profit and the total profits. Accordingly, therefore, any expansion of the business must be examined from the possible effects which the new products will have on the economic cycle and the several phases thereof. Those expansions which tend to decrease the turnover of working capital, decrease the load factor on invested capital, and lower the efficiencies of conversion are tending in the wrong direction and establishing elements of weakness in the enterprise.

As a general rule, any expansion which results in diversification in marketing is not economically sound, for the reason that it decreases the efficiency of conversion

by merchandising to a greater amount than it can improve the efficiency of conversion by use or production. It also seems to be the experience of many that a growth of the business by taking on the manufacture of accessories previously purchased from other manufacturers is not profitable. Some manufacturers who have adopted this policy in recent years have reversed themselves and are now concentrated on a restricted line of production and are having their accessories built by others who have specialized in that sort of production. The simpler the business, both from the standpoint of manufacture and of merchandising, and also from the standpoint of organization and management, the more readily may it be profitably conducted. This principle refers to businesses in a given class and does not apply comparatively to businesses in different classes. For obviously the textile business is very simple, both in its methods of production and in its merchandising, yet it is not so profitable generally as some other more complex businesses. This is due, of course, to the fact that there are other economic factors operative in the textile industries.

CHAPTER III

THE COST OF MANUFACTURING THE PRODUCT

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GOODS are priced to sell at a profit. Prices are, therefore, determined by the costs of manufacture and of distribution, since these factors establish the profit realized at a given selling price. This chapter does not deal in any sense with accounting methods or technique. It purposes to set forth those principles of which every manufacturer must have a thorough knowledge if he is to have a clear vision of the factors which influence the costs of production and of conducting the business. It is the duty of every manager to decide what factors are worthwhile taking into account in the operation of the business. It is the accountant's duty to devise and run the machinery of accounting, so that these factors which the management decides are important are regularly presented to the management for use in the control of the business. Unless the manager thoroughly grasps the principles which control costs, he is at the mercy of someone else to decide this most important question and, therefore, is not in real control of this phase of the business for which he is responsible. Fortunately, there are some very good accountants available who have a keen sense of manufacturing principles. But the manager should at least know the principles by which products accumulate costs,

in order to discuss these questions intelligently with his staff. This chapter is written for the purpose of clearly establishing these principles.

Definitions

When a chemist speaks of a " gram-molecule " or a physicist of a " volt " or a " coulomb," there is no confusion as to his meaning, because these terms have been rigidly defined, and their definitions accepted by all educated men. But when engineers, executives, accountants, or managers are discussing costs, and use such terms as " cost," " value," " profit," etc., there is always room for considerable misunderstanding, because these words have never been specifically defined in such a manner that the same definite idea is commonly conveyed whenever they are used. In order, therefore, that there may be no wrong interpretation, the reader is cautioned to give careful attention to the definition given each term as it is introduced in the subject matter of the text.

The manufacture of any commodity involves certain well-defined steps and necessitates the performance of certain services. Every manufactured article requires raw materials to begin with, and labor to operate on the raw material. But labor requires tools, housing, supervision, and other services.

Accordingly the principal divisions of manufacturing cost are

1. Materials cost.
2. Labor cost.
3. Service cost.

By *materials cost* is to be understood the cost of materials entering into the product directly, and becoming part of the product itself, as distinguished from the cost of those materials which are consumed in the operation of the plant and which do not enter into the product as a component part. The latter class of material may be termed " indirect material," and its cost is not chargeable to materials cost, but to service. The materials cost of a chair, for instance, will be the cost of the wood, glue, leather, screws, etc., from which the chair is actually constructed; while the oil and belting used in running the machines used in making the chair, the brooms worn out in sweeping out the shop, the coal burned for heating and power, and other materials of similar nature, would all have their costs charged to service.

Labor cost will refer to wages paid to labor directly engaged in such processes as forming, shaping, and assembling materials and attending production processes, as distinguished from the wages of that class of labor which is generally employed over a wide range of highly essential but indirect services, such as keeping the factory and premises clean, timekeeping, moving materials, fixing belts, running the power plant, keeping records, etc. This second class of labor may be called " indirect labor," because it cannot be directly and conveniently associated with specific productive processes or with specific products or parts thereof. The word " productive " is used in the sense of forming and shaping materials. Indirect labor is sometimes referred to as " non-productive " labor, but the term is not accurate

by description, and its use often leads to a false conception of the value of such labor. The use of the expression " non-productive labor " should therefore be discouraged, and the more fitting one, " indirect labor," used instead.

From the standpoint of cost determination, the item of *services* may be conveniently divided into two classes. Those services which are due to the possession and operation of the factory may have their costs grouped under the heading of *factory expense*. Factory expense items may be attached on some rational basis to the various products made in the factory, so that it may be determined, for example, in a plant manufacturing machine tools that 25 per cent of the factory expense is occasioned by the production of lathes, 10 per cent by the production of grinding machines, 60 per cent by the production of drill presses, and so forth. The cost of those services which cannot be conveniently associated with the manufacture of specific products or connected with definite productive processes are termed " general expenses." These again fall into two groups: *administrative expense* and *selling expense*. The salaries of administrative officers, and especially that portion paid them for time spent on problems of financing the business, considering new lines of manufacture or attending conferences, cannot be rationally associated or subdivided into making lathes, milling machines, or radial drills. So also it is impossible to subdivide the different items of selling into equitable charges against specific products. The cost of such service must be generally distributed to the operation of the business as a whole.

To recapitulate, for convenient reference, the several elements of cost may be grouped as follows:

1. Material cost. The cost of materials entering into and becoming part of the product as sold.

2. Labor cost. The cost of labor which can be directly associated with a specific product or process.

3. Service cost, sometimes termed: overhead, burden, expense, sur-charge, etc., consisting of

a. *Factory Expense:* All costs other than direct materials and direct labor which are occasioned by the possession and operation of the factory.

b. *General Expense:* (administrative and selling) All costs other than above accounted for. These costs cannot be directly associated with specific products or processes.

Typical items of *factory expense* are:

1. Indirect labor.
2. Indirect material.
3. Superintendence.
4. Heat, power, and light.
5. Tool room.
6. Maintenance and repairs.
7. Buildings and grounds.
8. Insurance.
9. Taxes.
10. Depreciation.
11. Other minor expenses.

General expense items are of two general types:

Administrative expense:

1. Salaries.
2. Traveling.

3. Legal.
4. Telephone and telegraph.
5. Supplies and postage.
6. Other minor expenses.

Selling expense:

1. Salaries.
2. Traveling.
3. Advertising.
4. Conventions.
5. Commissions.
6. Telephone and telegraph.
7. Supplies and postage.
8. Other minor expenses.

The above general classification is well shown in Fig. 6 in which it will be observed that *prime cost* is the sum of materials cost and labor cost. If to prime cost is added the item of factory expense, the sum is what is known as *factory cost*. The *total cost* is made up of factory cost plus general expense. If the total cost is

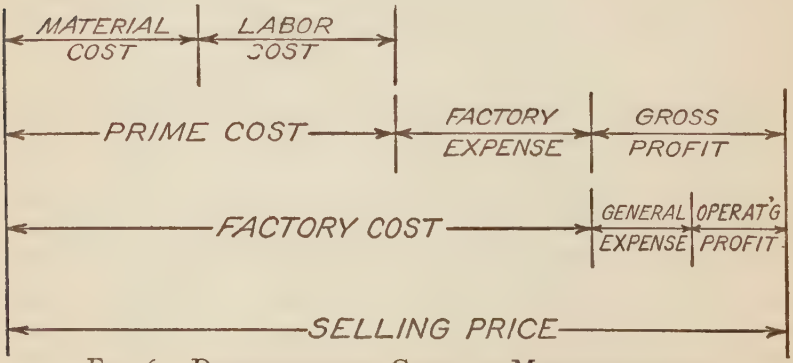

Fig. 6. Definitions of Costs in Manufacturing

deducted from the selling price, there results the *operating profit*. Operating profit is to be distinguished from *gross profit*, which is the difference between selling price and factory cost. With reference to each of these items it may be stated that materials cost and labor cost, and hence Prime Cost, may easily be determined for any specific product made, by simple and direct accounting methods. Factory expense as a whole may be readily computed, but its apportionment to specific products made or to processes cannot be accurately determined when a variety of products is being manufactured or a group of processes is being operated in the same shop; and therefore there have been devised certain approximate methods of apportionment to classes of product made or processes conducted.

It is, as a rule, impossible to apportion general expense to products when different kinds of products are made in the same plant; and therefore total costs of specific products of this sort of a factory cannot be determined, although the *total* cost of *all* products turned out in a given time may be quite closely approximated. The same applies to operating profits: that is, while the operating profits of the business as a whole may be closely approximated, the operating profit on specific products of a factory manufacturing a number of different products cannot readily be determined. The nature and determination of both gross profits and operating profits will be more thoroughly dealt with in a subsequent chapter.

Determining Factory Cost

The determination of the factory cost of a product involves the determination of the materials cost, the labor cost, and its proportion of factory expense. Materials costs are easily found by direct accounting for materials withdrawn from stores against particular order numbers used in controlling the production of each unit of output. It is unnecessary to dwell at any length on this item of cost finding.

Labor costs are also determined by direct accounting for the time of each direct-labor worker on each job, so that there is no special difficulty associated with direct-labor costs.

In determining the apportionment of factory expense to products made, there are many factors involved; and a clear understanding of this problem must be founded upon a knowledge of the characteristics of factory expense.

Factory Expense. — Factory expense has been defined as that expense other than direct labor and direct materials, which is occassioned or brought about by the operation and possession of the factory. The items of this expense account are:

1. *Indirect Materials.* — In the operation of every plant there are used quantities of material such as oil, waste, brooms, files, belting, and other supplies; furnaces must be relined, boilers retubed, broken windows glazed, and the general " housekeeping " of the whole plant carefully looked after. The cost of these materials worn out or used up in the operation of the busi-

ness is not specially associated with any definite product or process, but the expense is necessarily incurred by the operation of the plant as a whole, and is spread over all processes and products.

Sometimes it is convenient to group indirect materials costs under several different heads, in order that the whole cost of any service department, as distinguished from a processing department, may readily be determined. All indirect materials used in the power plant in the work of maintenance and repair, might be listed as materials costs, power-plant maintainance, while materials used in repairing the building may be listed under the item of building maintenance. Accordingly, any operating statement will usually not show all indirect materials cost under a single heading.

2. *Indirect Labor.* — There are two general classes of labor employed in a factory: direct labor employed at productive processes, and labor employed in the service departments. Such labor may be skilled or unskilled. Indirect labor employed in the tool room, for example, will be skilled; sometimes more highly skilled than the direct labor employed in processing. But it is not generally possible to associate the wages paid to the men in the tool room with particular products being made in the plant, because the results of their work are so broadly applied to factory output as a whole. The labor employed in moving materials about the plant is unskilled and indirect. Checkers, inspectors or timekeepers, and all others whose duties lie in similar fields are employed in so-called " service " departments, and their labor is all indirect. As in the analogous case of

costs of indirect materials, the cost of indirect labor may not appear in the operating statement as a single item, but may be associated with a number of separate items, according to convenience, or the personal ideas, of the management.

3. *Power, Heat, and Light.* — All costs incurred in the providing and maintenance of this class of service are chargeable to factory expense, and will include wages paid, fuel consumed, and such items as insurance and depreciation, just as if the power plant were a separate industry by itself. Practice in accounting for the cost of power, heat, and light varies quite considerably. Sometimes, insurance and depreciation are not included, but appear under the general heading of insurance and depreciation for the entire plant. Therefore it is always necessary in comparing the power costs of different plants, to know how these costs have been itemized. Sometimes it is good practice to omit insurance or depreciation from the accounting of specific service departments, such as the power plant, and include such items in the accounts of the factory as a whole. The point is, when such is the case, be sure to *know* it when making any study of the situation.

4. *Insurance.* — This is a service rendered by society. People contribute to a common fund for the purpose of the group who may suffer misfortune through fire or other calamity. The cost of this service is a factory expense due to the possession of the factory itself.

5. *Taxes.* — The service rendered by the community to its members is paid for by taxes. Protection against fire, police protection against theft and riot, and all

other municipal, state, and national services are paid for through taxes. This is properly chargeable to the possession of the factory.

6. *Depreciation.* — All wear and tear of machinery and buildings must be charged to factory expense, since it is caused by the operation of the factory, and is just as much a cost of producing an article as the cost of the material of which it is composed, or the labor employed in shaping it.

7. *Service Department Costs.* — The departments of operation of a factory may conveniently be divided into *processing departments* and *service departments.* Tool rooms, store rooms, shipping and receiving departments, drafting rooms, shop offices, yard gangs, pattern shops, etc., are all service departments; and the costs of operating these various activities are chargeable to factory expense.

The determination of factory expense as a whole is a simple matter in accounting; and it is beyond the scope of this text to deal with such accounting methods. It is important, however, to give some attention to the problem of determination of rational relationships between the incurring of factory expense and the products made or processes conducted: that is, to determine rational methods of apportionment of factory expense to products or processes. To this end *the characteristics of factory expense* will be considered here.

Insurance, for instance, is a function of time: *i.e.,* if 1,000 articles are produced per month, or 2,000 articles are produced, the total amount of insurance to be paid is not affected, since it is so many dollars per month.

However, the cost per unit of product on account of insurance will vary inversely with the number produced in a given time. *Taxes* are also a function of time; and so, likewise, is *depreciation,* generally considered. Of course, if a plant is run both day and night, the machinery will wear out faster than if operated in daytime only; but that will not vary the characteristic nature of depreciation, in respect of time.

Wages paid are also a function of time, whether paid by the hour or by the month. Hence, the wages of all service employees, clerks, foremen, superintendents, and others vary directly with time. The number of employees engaged may, however, vary with the output of the plant. If, for example, the plant output is 50 per cent of capacity, a fewer number of helpers of various sorts will be employed than when the output is 100 per cent of plant capacity.

Indirect materials cost, however, is not a function of time. The amount of indirect material consumed in a process will depend upon a variety of factors. But in general it may be taken to depend upon the number of units made; that is, the amount of indirect material consumed will vary directly with the number of products turned out.

While the above characteristics of the several elements of factory expense appear as stated, it must be borne in mind that, in order to devise any rational scheme for associating factory expense with products made, we must also consider to just what extent each process or article produced is accountable for certain details of factory expense. An article made by machine

will require power, while one made at the bench will not. Heavy articles require a great deal of labor in transporting about the factory; light ones, little or none. Articles requiring heat treatment require fuel, which is not needed for articles not heat treated. If certain processes involve a fire hazard while others do not, the insurance charges should be higher on the more dangerous processes. Again, parts made to close dimensional limits need more supervision, inspection, and engineering than those which can be made with considerable tolerance. The making of some articles involves investment in expensive machinery, with consequent costs in depreciation and attendance, while others may be produced on simple machines, not entailing these high costs.

Apparently, therefore, the conditions to be met are quite varied, and any system of apportionment of factory expense even approaching to close accuracy must necessarily be quite complex, especially for a plant manufacturing a variety of articles. By a " variety of articles " is meant a large number of different kinds of units, as lathes, drill presses, etc.

To meet this problem of factory-expense distribution, there have been devised certain methods which are in general use. These methods will be presented and an attempt made to point out the conditions under which each is applicable to the approximate determination of the factory expense of manufacturing any given article or product.

Systems of Factory-Expense Distribution

The systems of factory-expense distribution which are in general use are:

1. Distribution by materials.
2. Distribution by percentage on wages.
3. Distribution by productive hours.
4. Distribution by machine hours.

Each system is based on a forecast, from records of past performances, of the probable total factory expense for a given period. For example, if it is found that the factory expense of a given plant for the past year was $9,000 per month on the average, and it appears that the operation of the plant for the coming year would continue on practically the same scale, so far as volume of production is concerned, and that materials and wages would remain about the same, then it could reasonably be expected that the same monthly factory expense of $9,000 would be incurred for the coming year. The reason why it is necessary to forecast this probability is that it is impractical to wait until the end of the month, and accounts rendered some days afterwards, in order to ascertain the exact factory expense, and then to enter the record of factory cost on all detailed cost records of parts finished during the month. Cost must be determined from day to day; furthermore, costs as determined by months are only a matter of convenience, and it is quite as accurate to average the factory expense items as it is to approximate its apportionment by any of the methods in current use. It is necessary, however, to use the estimated factory expense over a reason-

able period of time in order that cost records may be compared from time to time. Accounting for the difference between estimated factory expense and actual factory expense will be dealt with after some consideration has been given to the question of distribution.

Expense distribution by the percentage on materials is accomplished in the following manner: Assume an estimated monthly factory expense of $9,000; also that past records indicate approximately $6,000 worth of direct materials consumed per month. From these figures it is established that for each $1 spent on materials, $1.50 is spent on factory expense. Accordingly, if a given article when finished is found to have incurred a labor cost of $6 and a materials cost of $2, there is added a charge on account of factory expense, of $3, giving a factory cost of $11. Let it be further assumed that after the books are closed at the end of the month, it is found that $6,500 worth of direct material was used in the manufacture. By the above method of cost distribution, 1.5 $\times$ $6,500 or $9,750 has been distributed to the various products made, on account of factory expense; and this amount has been accumulated to the inventory account. Now suppose the books of account show that only $8,500 had been incurred as factory expense: how is the difference between the $9,750 apportioned and the $8,500 incurred, to be accounted for? It may very easily happen that in the following month, $9,500 factory expense may be apportioned and accumulated to inventory and the books of account may then show an incurred factory expense of $10,000. In the first case, the factory expense was overapportioned,

and in the second case, underapportioned. These differences of $1,250 overapportioned expense and $500 underapportioned expense are appropriately recorded in the monthly Statement of Profit and Loss, as will be shown in a later chapter.

From the foregoing remarks on the characteristics of factory-expense items, it will appear that, in general, the cost of material used bears no very direct relation to the incurring of factory expense and, therefore, the apportionment of factory expense on the basis of raw materials used is not usually applicable. However, if the end result of the factory is a bulk product, such as sugar, cement, iron castings, and the like, then the factory expense may be apportioned directly to the end results or products. In such factories, however, it is not necessary to determine costs day by day, as the products are turned out, but the total factory expense is determined from the books of account at the end of each month and the ratio of factory expense to weight or bulk of material produced, is determined. If, for example, the factory expense of a cement plant for any given month is found to be $8,000, and the number of barrels produced is 25,000, then the factory expense per barrel is found to be $8{,}000 \div 25{,}000 = 32$ cents per barrel. In such cases over- and under-absorbed expenses are not encountered. In such factories, however, it may be found desirable to determine the apportionment of factory expense by processes in order to compare the economy of operations of each processing department from month to month.[1]

[1] See p. 79.

In foundries producing a uniform style and weight of casting, the factory expense may be apportioned to the production for the month on the basis of the poundage produced. If, for example, the factory expense for the month for a brass foundry is $80,000, and 400,000 pounds are produced, the factory expense per pound is 20 cents. A casting weighing 3 pounds would accordingly be apportioned a factory expense of 3×20 cents $=$ 60 cents. When, however, the foundry produces a wide range of castings, some of which may be very heavy and require intricate core work while others are comparatively light and require no core work, obviously, each class of castings is not equally responsible for the factory expense incurred and, therefore, a subdivision of factory expense must be made, applicable to each class of castings. That is, each class of castings will bear a predetermined proportion of the factory expense. Suppose, for example, there are found to be three classes of castings to be designated as Class A, Class B, and Class C. A careful study of the operations attending the production of each class in the matter of factory expense involved may indicate that Class A occasions 50 per cent of the factory expense; Class B, 30 per cent; and Class C, 20 per cent; when the ratio of poundage of each class produced to the total output is a given amount or lies between certain limits. Accordingly, if the total factory expense is $100,000 for a given month, all castings of Class A produced in that month should be burdened with 50 per cent of $100,000 or $50,000, while all castings of Class B should be burdened with 30 per cent of $100,000 or $30,000, etc. It is important to note, how-

ever, that should the ratio of poundage of each class to the output be materially changed, then the percentages of factory expense to be applied to each class should also be changed. If the entire foundry is used to produce Class A castings alone, it is obvious that 100 per cent of the factory expense would be thus incurred by Class A products.

It may be stated, in conclusion, that the apportionment of factory expense by the percentage on materials methods:

1. Is applicable to the condition that the processes of the plant are concerned with a series of operations on a bulk material such as sugar, soap, cement, castings, forgings, paper, pulp, paint, bread, yeast, and the like.

2. That when the final products, although the processes are common to all products up to a certain point, are of different style or types, such as in the case of the foundry referred to above, the factory expense should be apportioned to the several styles or types of products after a careful analysis of the extent to which each is responsible for the factory expense incurred.

3. That the apportionment of factory expense as just indicated, since it must necessarily be founded upon a given ratio of poundage of each style or type to the output of the plant as a whole, is no longer a correct apportionment when the ratios are changed to a considerable extent and, therefore, a reapportionment must be made in order for a true cost to be determined.

4. That in plants of the above type it is useful to determine the portion of the factory expense to be borne by each process or each group of related processes and,

therefore, the total factory expense should be apportioned according to processes or groups of processes on the basis of the responsibility of each in the incurring of the factory expense.

5. That the apportionment just indicated may be made by careful determination of the amount of power, heat and light, insurance, taxes, and indirect material, indirect labor, and other items of factory expense entering into each process or group of processes, and applied to the cost of the product on the basis of the poundage produced in the time during which the expenses were incurred.

6. That since some of the factory expense items (and in some cases a large proportion) are constant for the month, the factory expense per pound of product produced will vary in accordance with monthly production.

The percentage on wages method of apportioning factory expense is based on the proposition that for every dollar of wage paid to direct labor in a given factory there are incurred X dollars and cents of factory expense. Accordingly, if it is found that direct-labor wages in a given factory are $12,000 for the month, and the factory expense is $15,000 for the month, then it appears that for every dollar paid to direct labor as wages there are expended $1.25 for factory expense. There can be no doubt but that this computation is arithmetically correct; it remains to be seen, however, under what conditions the use of this method may not be economically correct in determining the factory costs of specific products of the factory.

If, under the conditions just given, an article manufactured is found to have incurred a materials cost of $3.25, and a direct-labor cost of $6, there would be apportioned to this article a factory expense of 1.25 × $6, or $7.50, resulting in a factory cost of $3.25 + $6 + $7.50 = $16.75. This method of expense distribution, like the previous method, is based on an estimate of the probable factory expense to be incurred in the month, and also on estimated direct-labor payroll for the month, and therefore its use gives rise to an underabsorbed or overabsorbed expense when actual performance varies from the estimate. That is, if the estimated payroll for direct labor is $12,000 for the month, and the estimated factory expense is $15,000, and therefore the estimated factory expense to be attached to each article produced is 125 per cent on the direct-labor cost of the article, should the direct-labor payroll turn out to be $13,000 and the factory expense be $14,500, then the sum of the estimated factory expenses on all articles produced during the month will be $13,000 × 1.25 = $16,250, which amount will have been entered in the inventory account during the month. But since the actual factory expenses were only $14,500, the inventory is too large by the amount of $16,250 — $14,500 = $1,750 and, therefore, this amount must be entered as a deduction in the operating statement on account of overabsorbed factory expense, or dealt with otherwise in the inventory account.

This method of factory-expense distribution is based on the theory that each article made incurs a factory expense in direct proportion to the direct-labor wages

paid in its production. This theory therefore assumes that each item of factory expense is a function of direct-labor wages and, therefore, that the items, for example of indirect labor such as tool-room service, power, and indirect materials, to mention a few, are functions of direct-labor wages. Accordingly, let it be assumed that a given plant has in it a group of machines using special tools which must be fitted to the machines for each job, as well as having a group of benches at which skilled mechanics are at work at hand processes. The machine laborers require power for operating the machines: tool-room service for making, repairing, and setting up special tools; laborers to bring castings and take finished parts away; men to repair belts and oil the machinery; men to sweep away the chips. The machinist at the bench requires no such service. He is working with equipment which has little depreciation and has no demand for power. Is it reasonable to assume that an hour's work at the machines at 60 cents per hour will incur a factory expense of only two-thirds of that incurred by an hour's work by a machinist at the bench receiving 90 cents per hour? Yet that is the basis on which the apportionment would be made by this method. Clearly, therefore, if such conditions obtain in a factory, the percentage on wages method of factory-expense distribution is not equitable.

The writer encountered this method of factory-expense distribution in a factory manufacturing metal furniture, metal shelving and vault fixtures, bank fixtures, and similar equipment. It served quite well for the apportionment of the factory expense as a whole,

that is, there was little over- or under-absorbed expense month by month. It happened, however, that all products did not equally engage the attention of all departments of production. In fact, some products never passed through certain departments. Some products passed through departments employing very expensive machinery using considerable power, while other products were largely made at the bench. It was quite evident that the ratio of factory expense to direct-labor wages was not the same for all departments and, therefore, any such ratio, arithmetically correct for the plant as a whole, was not applicable to individual departments. After investigation, it was found that some departments had a ratio as high as 225 per cent, while in other departments (bench work) the ratio was only 35 per cent. The factory as a whole had a ratio of 100 per cent. Quite obviously, the result of applying the 100 per cent ratio to each department was that the cost of some products was estimated too low, and bids based upon these estimates resulted in securing orders on which no profit was being made, while other products were estimated at too high cost and business was not as readily secured in competition with other manufacturers who quoted lower prices. Now the plant as a whole was earning a profit but it was found, upon reapportionment of factory expense and consequent revision of price lists, that the business expanded along safer lines and larger profits were earned. The fact that one line of products may bring a profit of $100,000 while another line may lose $20,000 is not always apparent when the mind is focused on a net profit of $80,000. Especially when

that is a fairly good profit on the amount of goods sold.

The conditions under which the percentage on wages method may be fairly applied in the determination of factory costs are:

1. When the skill of the workers and their rates of pay are uniform and the type of equipment they use is fairly similar, and they are all working on the same general class of work.

2. When the factory is divided for purposes of cost finding into productive divisions and each division has a proportionate factory expense applied to it in accordance with the extent to which each is responsible for the factory expense, and each division is uniform in equipment and workers on each product engage the attention of all groups of machines in that division.

If the conditions are as given under 2, it may be found that there are three principal productive divisions to be known as Department A, Department B, and Department C, and the percentage on wages applicable to each may be 100, 50, and 125 per cent, respectively. A given article may be made in Departments A and C, at direct-labor costs of \$4 and \$3, respectively. The factory expense to be charged will accordingly be (\$4 × 100%) + (\$3 × 125%) = \$7.75. Another article may be made in Departments A, B, and C at direct-labor costs of \$2, \$5, and \$1, respectively. The factory expense on this article would be (\$2 × 100%) + (\$5 × 50% + \$1 × 125%) = \$7.00.

The productive hour method of factory-expense distribution is based on the assumption that factory-

expense is a function of time and, therefore, an article in passing through the factory should be assessed a factory expense in direct proportion to the time of direct labor engaged in its production.

The determination of the factory expense per productive hour to be used in cost determination is made on a prediction of the probable total factory expense and the probable total productive hours (hours of direct-labor) for the monthly period. Past records and probable future sales are used in these determinations. Should it be estimated that the probable factory expense for the month may be $6,400 and the probable direct-labor hours may be 8,000 for the month, then the estimated factory expense per productive hour (direct-labor hour) is 80 cents. Accordingly, the factory cost with this method of expense distribution may be, for a given article:

Direct Materials	$2.25
Labor 5 hours at $0.70	3.50
Factory Expense 5 hours at $0.80 ...	4.00
Factory Cost	$9.75

In general, the productive hour method of expense distribution may be considered more rational than the percentage on wages method, because it is based on the principal factor of factory expense which is time. However, it must be used with the same discretion and common sense as was indicated for the other methods of expense distribution presented above. Obviously, if the productive departments of a factory vary widely in the

nature of equipment and skill of operators, no *average* expense per productive hour will be indicative of the real factory expense of any department and, therefore, not useful in cost determination. The conditions under which this method may be used with any assurance of accuracy are the same as given for the percentage on wages method.

The machine-hour rate of factory-expense distribution is based on the proposition that each productive machine in the shop may be treated as a miniature factory with a factory expense of its own. Also each bench at which direct labor is employed may be similarly dealt with, so that when the term " machine rate " is used, it refers to direct bench work as well as direct machine work. The determination of machine rates in any given factory is more involved than are the methods previously given, for it not only requires the forecasting of the probable factory expense per machine, instead of per department, but also requires an estimate of the probable number of productive hours each machine may operate in a given time period. The procedure in the determination of machine rates may be illustrated by the following brief example.

Suppose a given shop had five machines and two benches as shown in Fig. 7. The shop would be divided into compartments $M1$, $M2$, $M3$, $M4$, and $M5$ and $B1$, $B2$, as shown by the dotted lines, with each subdivision representing the areas required by each for the placement of the machine or bench, the workman and the piles of raw material and finished parts coming to and from the machine or bench. All taxes and insurance,

heat and light for the building would be apportioned to each machine and bench on the basis of floor areas occupied. The power consumed per hour by each machine would be found by test or estimated, together with a portion of the power required to drive the line shafting which, in some cases, may amount to as much as 40 per cent of the total power used. The wages per hour of helpers attending each machine are determined or the proportion which each machine may demand if a helper may serve in handling materials for and in cleaning several machines. The depreciation of each machine or bench is estimated as well as the normal maintenance and repair bills. Then the cost of operating the service departments, such as stores, shipping, engineering, tool room, supervision, inspection, etc., is apportioned to each machine on some rational basis establishing the extent to which each machine or bench may be responsible for the cost of operating each de-

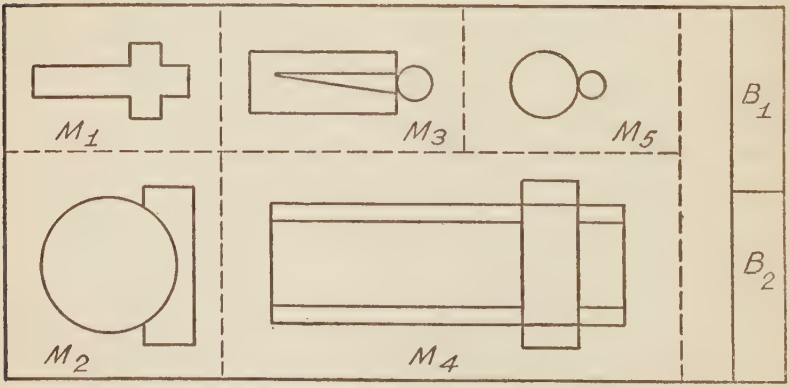

Fig. 7. Layout of Shop Floor to Determine the Machine-Hour Rate of Factory Expense

partment. By taking each item of the factory expense as just indicated, a total cost of operating each machine or bench in a given time period, the month for example, is found. The sum of all these must check with the total factory expense estimated for the monthly period from the past records of the business. In conjunction with some of the above items, and in final determination of the machine rates, the probable length of time each machine may operate in the month must be determined. Some machines will be operated the whole time, say 200 hours for the month, while other machines, the records may show, operate approximately half the time, or 100 hours for the month. Others will operate different times. Accordingly, then, each total machine expense for the month divided by the expected hours of operation during the month determines the machine rate of each machine or bench. Thus it may occur that in the example suggested by Fig. 7 the machine rates may be

	Per hour
$M1$	$1
$M2$	$1.50
$M3$	$0.75
$M4$	$3
$M5$	$0.50
$B1$	$0.30
$B2$	$0.30

A given part using $M1$ for 2 hours, $M5$ for 3 hours, and $B1$ for 1 hour, will accumulate a factory expense of

$$2 \times \$1 + 3 \times \$0.50 + 1 \times \$0.30 = \$3.80$$

This method, based upon a closer analysis and subdivision of expenses than the previous methods, may be expected to give a more accurate determination of factory expense per article produced, provided the total factory expenses incurred in the month and the actual times of operating each machine are in close agreement with the estimates. Naturally, if there is any considerable departure in the work of the shop in one month, as compared to another, such, for example, as unusually large orders, or if a variety of products is being manufactured, and the demands in production of each variety change and thus alter the time loads on the machines from month to month, this method may fail to approximate true costs. Accordingly, therefore, this method of expense distribution is useful the more nearly the shop is operated on a uniform schedule month by month.

The Application of a Selected Method of Factory Expense to a Particular Business. — The foregoing brief statements of the principles underlying the usual methods of factory-expense distribution to products made or processes operated do not set forth all of the factors which must be dealt with in arriving at a cost analysis of a particular manufacturing enterprise which will approximate true costs and, therefore, a knowledge of these methods as methods is not alone sufficient for arriving at an understanding of the economic characteristics of a manufacturing business. Like many other *general principles,* they are easily understood in the abstract, but not always readily applied to particular cases. Before applying any of the above methods, we must carefully analyze the nature of the business itself.

CHAPTER IV

THE TRUE CHARACTER OF A BUSINESS AND ITS RELATION TO COSTS

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IT IS strange how frequently business men are encountered who deceive themselves into believing they are in the manufacturing business when they are not. To illustrate my meaning, I will refer to a recent experience. A business man recently referred his difficulties to me for analysis and advice. His statements were headed —— Manufacturing Company and gave indication of his being in the materials manufacturing business. He had a small plant near the city and maintained a warehouse in the city, to which the material, after being processed at his plant, was trucked and from which it was delivered to contractors at different points in the city and nearby towns. A fleet of trucks was maintained for these purposes. An analysis of his operating statements showed manufacturing costs about 20 per cent of sales and delivery or trucking costs about 65 per cent of sales. The statements presented did not show these percentages, but an analysis of conditions and accounts disclosed these facts. He was greatly surprised when informed that he was not in the manufacturing business, but in the trucking business. The obvious remedy for his trouble was to put a competent man in charge of his warehouse and trucks and

organize their operations to prevent a 5-ton truck from delivering a 1,000 pound load a distance of 10 miles, and other similar performances.

Another similar situation is the business of manufacturing, selling, and distributing compressed gases such as oxygen, ammonia, etc. And there may well be added to the above subdivisions of the business, the business of getting back the containers. The cost of manufacture is a small part of the cost of doing business, in fact, it is a relatively small percentage of the cost of handling the containers.

The manufacture of granulated sugar is another instance. The cost of converting the raw sugar to granulated sugar may be between $\frac{1}{2}$ cent to $\frac{3}{4}$ cent per pound. The big problem in that business is the protection of the cost of raw sugar against commitments by a diligent hedging of the raw-sugar market.

Flour milling and cotton converting are in the same general class. Any manufacturing business in which the cost of raw materials is large in comparison with the cost of manufacture, and which is also subject to wide and sudden price fluctuation, must be largely conducted on the floor of the commodity exchange instead of in the factory office.

Some businesses, such as the manufacture and distribution of chewing gums, patent medicines, and the like, whose success depends largely upon consumer demand, are conducted from the advertising and sales-promotion offices rather than from the factory. Of course, economy of manufacture is always important and a dollar earned in savings in manufacturing opera-

tions is just as good as a dollar saved elsewhere. Other businesses may depend primarily for their success upon the very fine quality of the products manufactured, such, for example, as surveying instruments and chemicals. It is not to be assumed that the other factors of advertising, purchasing, and economy of production disappear in such businesses — they are not of the *relative* importance obtaining in some other businesses.

The problem, therefore, for any particular business is to determine the proper balance of all the factors which enter into the cost of doing business and to adjust these to the varying conditions of sales demand and price fluctuations which arise from time to time.

The characteristics of the business must first be determined before it can be controlled.

Some of the above considerations have more bearing on the problem of determining the economic characteristics of the business as a whole than upon the specific problem of determining a proper apportionment of factory expense to products made or processes conducted, while others have quite an important influence on the proper solution of the latter problem. In general, it may be stated that the selection and application of any specific method of apportioning factory expense must be preceded by an analysis of the business as a whole. As a result of such a survey, it may be found desirable to first treat the factory expense of the business as a whole by one of the following methods:

1. Subdivision by processes.
2. Subdivision by productive departments.
3. Subdivision by the character of the business.

Subdivision by Processes

In those businesses, the manufacturing division of which consists in the *processing in bulk* of a given raw material, or several materials, such as sugar, paper, cement, yeast, leather, glass, and like products, it is necessary to watch the costs of each operation or each group of like operations in order to insure economy of production as a whole. Unless costs by operations are ascertained, it will be impossible to locate the causes of the rise or fall of factory cost in any given period compared to a prior period. Therefore, the correct determination of costs by processes is important in such industries. Direct-material costs are easily determined for such industries. Direct labor does not have the significance it has in the metal-working industries where economy of production is in some measure dependent upon the efficiency of labor itself, and upon the management of such labor. Accordingly, the direct-labor item may not be determined by the direct-labor, time-card method, but may be associated with the processes at which the labor is engaged. In this respect it is handled like any item of factory expense.

It will also be noted that direct labor has not the same control on output as is the case with some other industries. When labor is required to attend an operation which is conducted for, say, 6 hours, at a temperature of a given amount, there is nothing labor can do to hasten or delay the operation. Furthermore, the wages paid to labor are applied to the same material batch after batch (if the batch method of operating is used) or to the whole material produced in the period of operation.

The accounting for labor by operations is accomplished by direct apportionment to the operations at which employed. The factory expense, however, presents a different problem for it is not usually apparent how much power, steam, water, gas, or other item of factory expense is consumed or occasioned by one process or another. It is only after a careful analysis based on measurements that any reasonable apportionment of factory expense to operations can be accomplished.

The first step in such an analysis is to prepare a *flow sheet* of operations. This is a statement, usually in graphic form, of the sequence of processes, together with operations companion thereto, through which the material or materials pass from the raw state to the finished product.

The next step is to block out the space occupied by each process on the floor plans of the plant, and to identify each piece of machinery and equipment used in conjunction therewith.

The third step is to determine the amount of fixed charges, such as depreciation, insurance, and taxes, associated with each process, and the amount, or proportion, of variable charges, if same are applicable to several processes, which each process occasions. The mechanism of the accounts may then be set up so that the total factory expense in any month may be apportioned to the processes responsible therefor. Monthly comparisons of these costs and the details thereof will then reflect the influence of changes in operation conditions or policy, and thus serve in the guidance of future operations. In Fig. 8 is given such a cost analysis for a

yeast plant, which shows the actual costs of each process in comparison with the estimated costs over a period of months. The costs were kept upon two bases, as shown in both the right and left edges of the chart. The percentages and amounts given were determined as standard costs from the budget. The light full lines opposite each division, and to the left of the heavy full lines, show how the unit cost items of the left-hand scale varied each month. The light dotted line to the right of the heavy full line shows how the unit cost items of the left-hand scale varied each month. The heavy full lines show total production cost for each month.

The Subdivision of Factory Expense by Productive Departments

Manufacturing plants, in general, may be regarded as made up of two classes of departments. One class of departments in metal-working plants, for example, consists of machine shops, foundries, and assembly shops. Such departments or shops are engaged in forming, or shaping, or otherwise treating the product. In this sense they may be termed " productive departments." Other classes of departments exist to render service to the productive departments. Such departments in metal-working plants are tool rooms, pattern shops, power plants, repair shops, etc. These may be termed " service departments." When the productive departments are quite different in character, and when some of the products of the factory do not pass through all of the productive departments, it becomes necessary to treat each

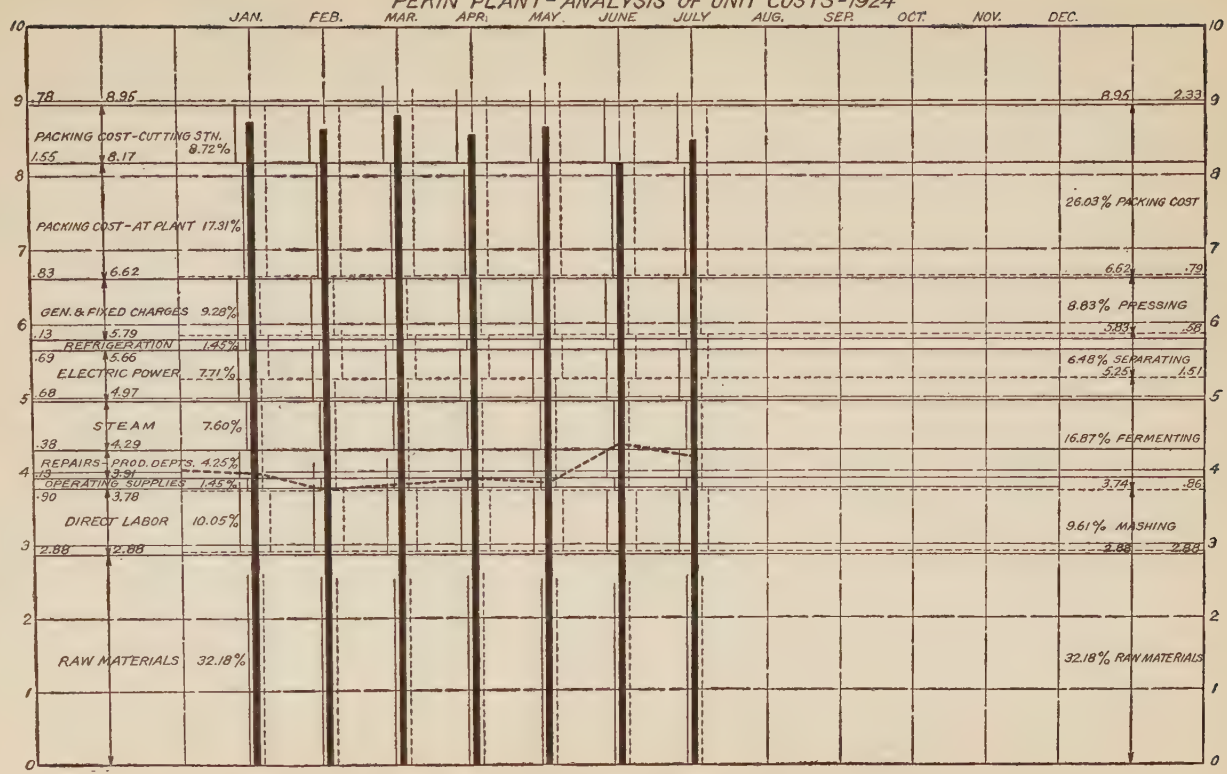

FIG. 8. GRAPHIC STATEMENT OF COSTS IN MANUFACTURING A CERTAIN FOOD PRODUCT

productive department as if it were, in a sense, a separate manufacturing plant. This demands that each productive department must carry a separate factory expense. Accordingly, therefore, it must be determined to what extent, from the standpoint of cost, each service department serves each productive department, as well as to determine the amount of fixed charges, such as taxes, insurance, etc., and also variable charges, each productive department incurs.

The following example will serve to illustrate the principles involved in this procedure.

A certain factory has five productive departments.

1. A machine shop for finishing iron and steel castings, bar stock, etc., the raw materials for which are purchased from outside sources.
2. A brass machine shop for finishing brass castings which are cast in the company's brass foundry.
3. A brass foundry.
4. A brass products assembly department.
5. An iron products assembly department.

The following service departments are maintained:

a. A pattern shop for making patterns for the brass foundry and for making patterns for iron castings which are purchased at various foundries in the neighborhood.

b. A tool room which serves for the making and repairing, as well as the care and distribution of tools for the iron shop, brass shop, foundry, and assembly departments.

c. A power plant.

d. A repair and maintenance gang for the upkeep of all machines and repair of buildings for all productive and service departments.

e. An engineering department for designing all products manufactured and occasionally designing equipment and fixtures for some of the service departments.

f. A storeroom for the custody of all raw materials.

g. A stock room for the custody of all finished products.

h. A shipping department.

i. A yard gang for general service.

j. A general factory office for planning, supervision, and record keeping.

The factory-expense items of the productive departments arise from two sources:

1. Each productive department employs indirect labor for moving material about and for other services. Each consumes indirect materials. Taxes, insurance, and other fixed charges are directly incurred by each productive department.

2. Each productive department is served by the service departments and, therefore, is chargeable with a portion of the cost of operating these departments.

The problem is to determine with a reasonable degree of accuracy, the total amount of factory expense to be apportioned to each productive department out of these two sources, that this expense may in turn be assessed against the products made in these departments. To this end it is convenient to set the problem in tabular form as shown in Table 1.

TABLE I

Items of factory expense	Productive departments					
Direct:	Total	No. 1	No. 2	No. 3	No. 4	No. 5
1. Taxes	420	100	80	20	160	60
2. Insurance	710	200	110	80	90	230
3. Indirect labor	5,000	1,000	800	1,200	1,500	500
4. Indirect materials	5,000	800	500	1,700	1,000	1,000
5. Supervision	2,500	500	900	600	300	200
6. Depreciation	1,700	400	300	200	600	200
Service Departments:						
a. Pattern shop	1,500	500	500	500		
b. Tool room	3,000	300	1,000	700	1,000	
c. Heat, light, and power	2,500	800	700	200	200	600
d. Maintenance and repair	1,600	300	200	500	400	200
e. Engineering and design	2,000	1,000	500	500		
f. Rough stores	2,500	600	800	300	500	300
g. Finished stock room	1,000	100	200	600	100	
h. Shipping	1,300	700	600			
i. Yard gang	4,000	800	600	1,000	1,200	400
j. Factory office	2,500	600	900	200	300	500
Total	37,230	8,700	8,690	8,300	7,350	4,190

The cost of operating each service department must be determined by an analysis of the items of expense which it incurs. The pattern shop may be taken as a typical example, for which the items of expense may be:

1. Materials (direct and indirect).
2. Heat, light, and power.

3. Insurance.
4. Taxes.
5. Labor direct and indirect.
6. Maintenance and repairs.
7. Depreciation, etc.

The probable magnitude of each of these items for any accounting period, say for 1 month, may be found as follows:

1. Materials — estimated from past records.

2. Heat, light, and power — from inspection and test, as a result of which it may be found that 6 per cent, for example, of the entire cost of this item, for the whole factory for the month is probably caused by the operation of the pattern shop.

3. Insurance — from wages of employees for compensation insurance, and from proportion of value of machinery and inventory to value of machinery and inventory for the whole plant for fire insurance, and from area occupied to entire area of all departments for fire insurance on building.

4. Taxes — from proportionate value of building and equipment of pattern shop and the whole plant.

5. Labor — estimated from past records.

6. Maintenance and repairs — estimated from past records as pertaining to the pattern shop only.

7. Depreciation — from rates determined for each piece of equipment.

In like manner, the probable expense of maintaining each service department may be found.

The direct charges to the productive departments as listed in Table I, are determined as follows:

1. Taxes — same as above.
2. Insurance — same as above.
3. Indirect labor — from past records and from inspection.
4. Indirect materials — from past records and inspection.
5. Supervision — from past records and inspection.
6. Depreciation — from rates appropriate to each type of equipment.

The apportionment of the totals of the above items (direct and service department charges) to the productive departments may be made as follows: All of the direct charges, with the exception of supervision, are determined separately for each department as indicated above. Supervision may be apportioned with reasonable accuracy on the basis of the number of direct-labor employees engaged in each productive department to the total of such employees for all productive departments. The pattern shop may be assigned as an item of factory expense to the brass foundry and to the iron machine shop in proportion to the average wages paid for work on patterns for the iron foundry and for the brass foundry, as shown by the records of past performance. Thus, if two-thirds of the wages paid are for patterns for iron castings, and one-third is for patterns for brass castings, then the estimated total cost of operating the pattern shop will be apportioned two-thirds to the iron machine shop and one-third to the brass foundry. The total cost

of operating the tool room will be apportioned to iron machine shop — and the brass machine shop on the same basis. The other productive departments will use the tool room so little in comparison to these machine shops that it is within the degree of approximation to neglect them in this apportionment. If this should for any reason not be the case, however, then naturally that department which may require tool-room service to any considerable extent must be included in the apportionment.

Heat, light, and power must be apportioned to the productive department by test and inspection.

Maintenance and repair costs for each productive department as estimated from past records.

Engineering and design is so broadly used by the productive department that it is not readily seen how it may be rationally apportioned to the several productive departments. In all probability, the apportionment will usually be approximately right if made on the basis of the productive hours or direct-labor wage in each productive department to the total of productive hours or direct-labor wage of all productive departments.

Rough stores may be apportioned to the iron machine shop, brass machine shop and brass foundry on the basis of the floor space occupied and the proportionate amount of labor employed in handling the stores of each of these departments. If purchased parts for use only in the assembly departments are also handled as a part of the rough storeroom and if also finished parts are withdrawn from this storeroom for the assembly departments, then these departments must also participate in the expense of maintaining the storeroom and the participation may

also be made on the same basis. It is not always apparent how the cost of maintaining the finished stock room may be apportioned to the productive departments. In all probability, this had best be apportioned to the iron machine shop and the brass machine shop on the basis of the relative space occupied by each product. Shipping may be apportioned on the basis of the relative amount of expense in preparing and handling each class of shipments (iron products and brass products) and assigned to the iron machine shop and brass machine shop accordingly.

The cost of operating the yard gang in relation to the operations of the productive departments is not always apparent. Perhaps the best method of apportionment in this case is by inspection of the work done and by exercising judgment on the probable responsibility of each productive department for necessitating this work.

The factory office expense may be apportioned to the productive departments with some degree of accuracy on the basis of the productive hours in each department. It will be noted that by the above methods of apportionment, certain items of expense become attached to the factory expense of the productive departments though several channels. Taxes, for example, are a direct charge and also appear as items of the several service departments. Insurance is dealt with in like manner, and so are many other items treated likewise. It is also to be noted that the above determinations of factory expense of productive departments are estimates based on the best judgment that can be exercised on what will probably happen in these several

respects. Let it be assumed that such estimates as above indicated have been made for a given plant and that there result the totals and apportionments for a month as shown in Table I.

Let us assume also that the estimate of productive hours for each productive division for the month are as shown in Table II. Accordingly, therefore, the factory

TABLE II. PRODUCTIVE HOURS

	Productive departments				
Total	1	2	3	4	5
30,000	10,000	8,000	6,000	3,000	3,000

expense is to be apportioned to each product in accordance with the productive hours spent on it by each department at the following rates:

Cents per hour

$$\text{Department } 1 = \frac{8{,}700}{10{,}000} = 87$$

$$\text{Department } 2 = \frac{8{,}690}{8{,}000} = 108.6$$

$$\text{Department } 3 = \frac{8{,}300}{6{,}000} = 138.25$$

$$\text{Department } 4 = \frac{7{,}350}{3{,}000} = 245$$

$$\text{Department } 5 = \frac{4{,}190}{3{,}000} = 139.66$$

The average hourly rate will be $\frac{37{,}230}{30{,}000} = 124.1$

Suppose, for example, that a product had been manufactured exclusively in Department 1, and that 10 productive hours had been spent thereon. If an apportionment of factory expense by departments is made, the product will be charged with a factory expense of $8.70. If, however, only the total factory expense is used and all products are assessed at the average hourly rate, then this particular product would be charged with $12.41 factory expense. A product priced on this latter basis may not be sold in competition with other manufacturers who have a better knowledge of costs. If, on the other hand, a product is made exclusively in Department 4 and consumes 10 productive hours, it should be charged with a factory expense of $24.50. If the average rate for the entire plant is used, however, the factory expense incurred would be estimated at $12.40. Pricing on this basis, may result in business being secured but it would not be profitable.

Subdivision by Character of the Business. — Very frequently the business of a company involves not only the manufacture of machinery, equipment, or materials, but also the installation of the machinery and equipment, or the application of the materials to construction work. Under such circumstances, the company is engaged in both manufacturing and contracting. It is very frequently the case that such companies not only contract for the installation of the machinery or materials which they manufacture, but they also sell their products to others, who in turn act as contractors for such installations. A manufacturer of composition flooring material, for example, may also take contracts to

lay floors in hospitals, office buildings, and public buildings, in the community in which the factory is located, as well as sell the products of the factory to flooring contractors in distant cities.

Manufacturers of small ammonia compressors for refrigerating purposes usually take contracts for the installation of small refrigerating plants and, therefore, maintain a force of men for the installation of equipment over a considerable territory. For this purpose, also, the manufacturer may operate a " pipe shop " to make the coils and condensers, which together with the compressors constitute the principal material for the installations. He may also sell his compressors through resale agents who have their own " pipe shops " and take contracts for installation in other territories.

Manufacturers of fabricated steel for building purposes, particularly for building alterations and extensions, so many of which exist in and near our larger cities, frequently maintain a warehouse of structural shapes from which they withdraw materials for use in their own fabricating shop, on contracts which they have taken, and from which they also sell structural shapes to builders on emergency orders, and to other smaller fabricators who cannot afford to carry a large inventory of steel shapes. The owners of such an enterprise may be in the fabricating business, the warehousing business, and the contracting business.

A certain well-known manufacturer of watches whose business has recently been bought by other parties, produced in his own plant only 40 per cent by value and 20 per cent in number of the watches sold by the com-

pany. His principal business was, therefore, the merchandising of watches. Any number of similar examples might be given in illustration of the fact that many business enterprises, while apparently manufacturing, are in reality based upon or concerned with other operations as well. They are, therefore, essentially " compound businesses " conducted by a single organization. Any analysis of the economic characteristics of the business as a whole, in such instances, must be based upon an analysis of the economic characteristics of each component thereof. The economic operation of a power plant as a whole can only be accomplished by a proper control of each unit of the plant and this control can only be effected when the performance characteristics of each unit are understood.

The procedure to be followed in the subdivision of factory expense and general expense on the basis of the character of the business in the case of the refrigerating business referred to above, may serve as a typical example of such cases from which a set of principles may be deduced. This business involves the following operations or activities:

1. Manufacture of compressors and auxiliary parts.
2. Manufacture of coils and condensers.
3. Purchase of equipment such as motors, belts, etc., for use on contracts.
4. Contracting for complete installations in which the company's own compressors and coils are installed, and for which motors, ice boxes, and insulation are purchased for installation.

5. Sale of compressors to other contractors who install complete plants and who may operate their own pipe shops and purchase ice boxes, motors, etc., from other manufacturers or jobbers, or sale of compressors and coils to such resale agents who assemble the other equipment and install the plant.

A factory organization, with a superintendant, cost clerk, payroll clerks, stores system, and all other necessary service departments, is maintained to operate the compressor shop and the pipe shop.

A materials-procurement department purchases the castings and other raw materials for the compressor shop, the pipe shop, all supplies for the service departments, and all material for reshipment to contract.

The engineering department may design compressors, piping, and complete plants which the company installs on contract.

The shipping department prepares shipments to contractors and to purchasers of compressors.

The general office (executive department) directs the policies of all divisions of operation. Time is spent in formulating contracts for complete plants, and in promoting modern methods of manufacture in the compressor shop and in the pipe shop and on other corporate problems and interests.

The sales department is selling complete plants and also compressors to other contractors.

Thus it will be seen that many of the activities of the factory, office, and of the administrative and sales de-

partments, all of which occasion factory expense or general expense, are generally spread over the five divisions of operation or activities of the business. It is also apparent that resale agents who act as independent contractors are interested in purchasing compressors from the company at the lowest prices and the company is also anxious to sell these compressors at a low price commensurate with a reasonable profit, and thus meet competition and promote the widest distribution of its compressors.

Accordingly, therefore, the company must determine, with reasonable accuracy, the cost of manufacturing compressors as an independent enterprise. It would not be fair to charge the compressor-manufacturing department with the whole expense of operating the materials procurement divisions, nor even a considerable portion thereof, because this division spends most of its time and energy in procuring materials for the contract work and only a small portion of time in purchasing and following up raw materials for the compressor shop. Nor would it be fair to charge all advertising and sales expense to contracts for complete plants, for then the compressors would be estimated at too low total cost and actual net profits on such sales would be less than estimated profits.

The pipe shop must also be treated as an independent enterprise, if coils and condensers are also sold to resale agents and the total cost of its products determined on that basis. If other products are sold to independent erectors and also used on the company's own contracts, it is evident that the department in which such products

are manufactured must be treated as an independent enterprise for cost-finding purposes. A company operating a compound business must therefore have regard for the following principles:

1. All items of factory expense must be apportioned to the "independent enterprises" according to the responsibility of each.

2. The total of the *portions* thus found should constitute the total factory expense for each respective industry. Thus *A* per cent of factory expense of the business as a whole is the factory expense of the compressor shop; *B* per cent for the pipe shop; *C* per cent for contracting and erecting department; and *D* per cent for any other department there may be which sells goods to customers and to the company.

A per cent + *B* per cent + *C* per cent + *D* per cent = 100 per cent factory expense of the business as a whole.

3. All items of general expense must be apportioned to the independent enterprises according to the responsibility of each for the existence of such expense.

4. The total of the *portions* thus found should constitute the total general expense for each respective industry.

Accordingly, *A'* per cent + *B'* per cent + *C'* per cent + *D'* per cent = 100 per cent general expense of the business as a whole.

5. The cost of compressors for delivery to resale agents must be the same as the cost of compressors for delivery to the company. Likewise, for any other product similarly handled.

The apportionment of the factory expense of each productive department to the products of the factory is made in accordance with the principles set forth on pages 78 to 89.

In general, therefore, it may be stated that the foundation for determining the economic characteristics of any given business lies in the cost methods used for estimating the expense incurred by the divisions of the business, by the departments (production or processing) of the business, and their proper apportionment to the products made or the processes conducted, as the case may be.

CHAPTER V

THE ECONOMIC CHARACTERISTICS OF MANUFACTURING ENTERPRISES

CHAPTER V

THE ECONOMIC CHARACTERISTICS OF MANUFACTURING ENTERPRISES

EVERY manufacturing enterprise has certain definite characteristics of costs, earnings, and investment in plant, in relation to output and to other factors. The steel industry differs from the leather industry, a cement plant differs from a bakery, and plants in the same industry will differ from each other in respect to these relationships. Every engineering student knows what a water-rate curve for a steam engine is and how to read the speed-torque curve of an electric motor. The economic characteristics of prime movers have long been studied and formulated. Yet, strange to state, there has been no such analytical study applied to manufacturing plants. Industries are usually judged from their Balance Sheets and Operating Statements, but these are only partial indicators of the nature of an enterprise. What is required is a more comprehensive measure of their overall economic characteristics. Let us examine the usual economic factors of an enterprise and see if some relationships of value cannot be discovered about them. Let us take the cost data and inquire into the nature of costs. One of the first things we observe is that there are certain items of cost which are fixed, regardless of the condition of plant op-

eration or volume of goods produced, and there are other items of cost which vary with the volume of goods produced. Accordingly, we find that there are:

Constant total costs, such as insurance, taxes, rent, salaries of officers, and expenses of like nature. It will be noted that a constant total cost gives rise to a variable unit cost. That is to state, if the constant total cost of a given factory should be $500,000 per annum, it is constant regardless of the number of units produced. If, however, 100,000 units are produced in the year, the unit cost due to the fixed charges will be $5, while if 200,000 units are produced the unit cost due to the fixed charge will be $2.50. Thus the constant total cost gives rise to variable unit costs.

Variable total costs, such as direct labor, direct materials, commissions, and certain items of factory expense. In this case of variable total costs, we find there results a constant unit cost or perhaps we should state that the constant unit costs give rise to variable total costs. If, therefore, we examine the cost items of any business we will find that certain ones are constant, regardless of the volume of business done; others vary with the volume of business done, and others are made up of a portion which is constant and a portion which is variable. Power cost is one of the latter character. There is always a certain amount of power consumed, "standby" expenses which are incurred regardless of the volume of production; but as production increases, there is a certain amount of additional power consumed. The cost of shipping is another item of the same nature. There is a certain fixed charge for the maintenance of a shipping department, but as more goods are shipped,

more packing and carting expense is required. It also appears that the items, which vary with volume of goods produced tend to vary directly with the volume.

Assume for the purpose of illustration, the business of manufacturing and selling small drop forgings. We will assume that there are twenty hammers with any appropriate number of heating furnaces and other companion equipment. When the plant is running to full capacity all of the hammers are going and a full labor payroll is maintained. At 50 per cent output, approximately ten hammers are running, one-half of the number of workmen are engaged on direct labor, one-half the amount of oil is consumed for heating the raw stock. There may be two expert die sinkers who will be kept on the payroll, no matter what the output, because a good die sinker familiar with the type of work is a valuable man. Of course, if business drops off permanently, one man may be discharged. If board hammers are used and all are driven from a common line shaft, one-half the power will not be saved, because the line shaft will probably consume 50 per cent of the total power supplied the shop, and it will be run just the same for ten as for twenty hammers.

If individual drive is used, the reduction in power consumption with drop in output will be more marked, but it must be determined for each case. A certain percentage of the power cost may be fixed and the remainder vary with the output.

The wages of the superintendent of the shop will be the same, no matter what the output, unless, of course, a reduction must be made if the business falls off to a low point. The shop must be lighted the same for low

output as for maximum output, except, of course, that the individual machine lights used will vary, but in general it will not be noticeable.

The cost of selling the product may have a compound relationship to plant output. If the salesmen work on a salary and commission basis, then a certain fixed selling cost will obtain, together with a variable selling cost, depending on the percentage of commissions paid. Traveling expenses, advertising, legal expenses are fixed costs, but the probable total amount of these must be forecast or estimated from past records and foreseen future conditions, in case the analysis is made for the purpose of forecasting the probable earnings and costs in future operations.

And so each item of total cost must be carefully studied and its variations with output determined. As a result, some will be found constant, regardless of output, some will be found *reasonably* constant, some will be, say, 30 per cent constant, and 70 per cent varying directly with the output of the plant, and some will be found to vary in total directly with the output of the plant.

It was stated above that materials would vary directly with the output. This is quite true. If material is purchased in small lots for a small plant output, however, there may be a greater initial cost and higher freight cost per unit, due to shipments at less carload rates. If such is the case, to a considerable extent, then naturally the slope of the total materials cost line with output will not be constant, but will not be so steep during the range of low outputs.

The writer has encountered no cases in which the total cost of materials consumed did not vary directly with plant output, but yet there may be some businesses which he has not encountered in which the cost of materials may be affected by the amounts purchased.

It was also stated that direct labor would vary directly with the output. This is not strictly true for the following reason. It is true that the *tendency* is to vary directly with output, but since labor may slacken or increase output such that a man may produce, say, from twenty to thirty forgings of a given type in an hour, it is evident that the increase and decrease of direct-labor costs with output will be by steps rather than as a straight line.

However, for the purposes of this analysis the assumption of the tendency to vary as a straight line may be regarded as quite accurate. The above remarks refer to total costs only and this fact must be clearly in mind when thinking on this subject.

An Example

The annual Profit and Loss Statement of a certain manufacturing company shows the following conditions:

Net Sales		$2,500,000
Cost of Goods Sold:		
Material	$300,000	
Labor	500,000	
Factory Expense	750,000	
		1,550,000
Gross Profit		$ 950,000

Administrative Expenses	$200,000	
Selling Expenses	500,000	
		700,000
Net Profit		$ 250,000

An analysis of the factory expense shows that 60 per cent is constant and 40 per cent varies directly with the volume of production. The administration expense is found to be fixed. The selling-expense analysis shows that 50 per cent is fixed and 50 per cent varies with the volume of sales.

Accordingly, a regrouping of costs for the purpose of finding the relation of total cost to volume of sales will result in the following:

TABLE III.

	Amount	Constant total costs	Variable total costs
Material.....	$300,000	.....	$300,000
Labor.....	500,000	.....	500,000
Factory Expense.....	750,000	$450,000	300,000
Administration Expense..	200,000	200,000	
Selling Expense.....	500,000	250,000	250,000
		$900,000	$1,350,000

CONSTRUCTING THE BREAK-EVEN CHART

Let use assume that the plant is run at 100 per cent capacity, that is, the maximum annual volume of sales

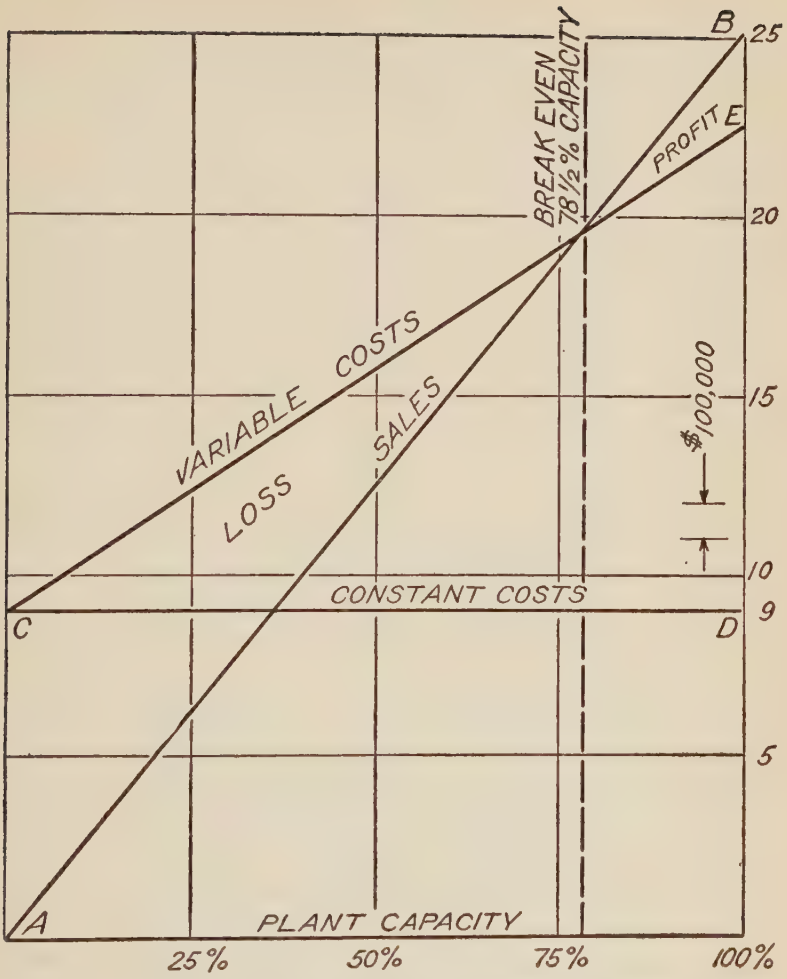

FIG. 9. THE BREAK-EVEN CHART — A GRAPHIC DETERMINATION OF THE ECONOMIC CHARACTERISTICS OF A BUSINESS

($2,500,000) has been attained. The variation of profit and loss to volume of sales at different plant capacities may be found by constructing the chart shown in Fig.9. This is accomplished as follows:

1. Divide the base of the chart into percentage of plant capacity.

2. At the right-hand edge of the chart, select a unit of measurement of 1 division equal to $100,000 as shown, and lay off 25 of such divisions to the point *B* to represent the annual sales of $2,500,000. Draw the line *AB*.

3. Draw the line *CD* at a height of 9 divisions to represent $900,000 fixed or constant total costs.

4. Locate the point *E* at a height of $13\frac{1}{2}$ units *above the point D* to represent the $1,350,000 variable total costs. This point will lie $22\frac{1}{2}$ units above the base. Draw the line *CE* to represent the variable costs.

This chart shows that the field of profit lies above $78\frac{1}{2}$ per cent plant capacity. That is, the business will break even at $78\frac{1}{2}$ per cent capacity. At this point, the total cost of operating the business (manufacturing and selling) will just equal the income from sales and hence there is no profit. In other words, if sales drop below $78\frac{1}{2}$ per cent of $2,500,000 or $1,962,500, the business will operate at a loss.

Determining the Break-Even Point or Point of Vanishing Profits by Analytical Methods

The break-even point of a business may be determined without the use of the chart by the following methods:

Referring to Fig. 9, the sales line AB may be expressed $y = x$, in which y equals sales, and x denotes the distance from the origin A at which the ordinate y is erected, and plant capacity is measured in dollars, that is, x and y are measured in the same units. The line CE may be expressed $y' = a + bx$, where y' is the distance from the base of any ordinate erected to CE, a is a constant (CA) and b measures the slope of CE with the base. In this case, if the base is laid off in dollars value of plant output, the slope of CE would be measured by

$$b = \frac{\text{variable total costs}}{\text{corresponding sales.}}$$

Thus

$$y' = \text{constant costs} + \frac{\text{variable total costs}}{\text{corresponding sales}}\, x$$

and

$$y = \text{plant capacity utilized}$$

The break-even point occurs where the line CE crosses the line AB, that is, where $y' = y$.

Therefore the break-even point occurs at that plant capacity where

$$y' = y,$$
$$a + bx = x,$$
$$\text{or } x = \frac{a}{1 - b},$$

or at the plant capacity

$$x = \frac{\text{constant total costs}}{1 - \dfrac{\text{variable total costs}}{\text{corresponding sales}}}.$$

For example, the break-even point for the business to which Fig. 9 refers occurs at the plant capacity

$$x = \frac{900{,}000}{1 - \dfrac{1{,}350{,}000}{2{,}500{,}000}}$$

$$= \frac{900{,}000}{1 - 0.54}$$

$$= \$1{,}962{,}500.$$

Comparison of Businesses

The relative economic characteristics of several business enterprises may be studied by the use of the graphic analysis shown in Fig. 10. Suppose, for example, Company A does $2,500,000 annual business at a net profit of 10 per cent, or $250,000; and Company B, manufacturing an entirely different product, with different manufacturing facilities and merchandising methods, also has annual sales of $2,500,000, and a net profit of 10 per cent. Is there any difference in the economic characteristics of the two businesses? Each returns a net profit of 10 per cent on sales at plant capacity. There may be a decided difference. Suppose, for example, that

the fixed costs of Company A are $900,000 per annum, while Company B has less invested in plant and machinery, but uses a much greater amount of labor or materials. Company B's fixed costs may be $250,000 and its variable costs for annual sales of $2,500,000 may be $2,000,000. The total costs for the same annual sales would be the same for each company.

	Company A	Company B
Constant	$900,000	$250,000
Variable	1,350,000	2,000,000
Total	$2,250,000	$2,250,000
Sales	2,500,000	2,500,000
Profit	$250,000	$250,000

Suppose, however, we superimpose the " break-even " charts of the two companies as shown in Fig. 10, and we find, among other things, that while both companies make the same profit when each plant is operated at full capacity, Company A ceases to make a profit below 78½ per cent capacity while at this point Company B still makes a profit of $150,000. Company B will just break even at 50 per cent capacity on sales of $1,250,000, but Company A will have a loss of $330,000 when its sales drop to $1,250,000. Thus we find that these two companies have entirely different earning characteristics.

A company having the characteristics of Company B is much more stable. It can stand a period of depression much more readily than can Company A. When sales drop, Company B consumes less materials in pro-

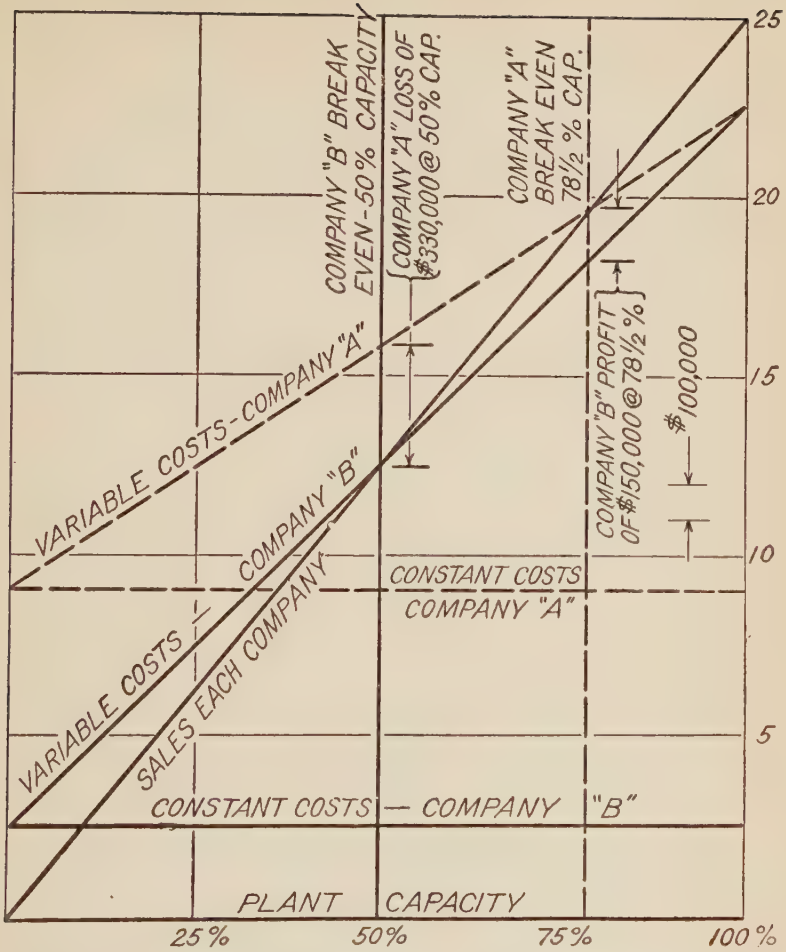

FIG. 10. COMPARISON OF THE ECONOMIC CHARACTERISTICS OF TWO DIFFERENT BUSINESSES WHICH HAVE IDENTICAL SALES AND PROFITS

portion to Company A and also lays off more help. It is much more flexible.

Company B can also withstand a drop in selling price much more readily than can Company A.

As industries tend to become more highly mechanical, that is, to depend more upon automatic machine processes and less upon labor, they tend toward the characteristics of Company A. While those industries which depend largely upon labor and are not "mechanized," tend toward the characteristics of Company B. However, there are some industries, such as the manufacturer of fertilizer, in which the material costs are about 74 per cent of the total cost of production, while labor cost is about $6\frac{1}{2}$ per cent and total factory expense is only 10 per cent of the cost of production. Such industries will also have the general characteristics of Company B.

Determining the Maximum Earning Capacity of a Business

A business may be earning a very small return on annual sales and thus be considered inherently a poor earner, where, as a matter of fact, it may have very substantial earning possibilities. Such a business is usually not being operated at its highest capacity and, therefore, is not using its plant to the fullest extent. The constant costs or fixed charges demand a more effective use of plant. Plant capacity may be expressed in annual sales volume possible at given unit prices for industries producing bulk articles, such as cement, paper, bread, yeast, soap, etc. When a diversified line of products,

particularly machine-shop products, is manufactured, the annual plant capacity in terms of sales in dollars is arrived at with more difficulty. Assume a business having an annual sale of $2,000,000, returning a net profit of $100,000 or 5 per cent on sales. If the fixed charges are $900,000 and the variable costs at annual sales of $2,000,000 are $1,000,000, and the plant capacity utilized is only 75 per cent, then by constructing the chart, as shown in Fig. 11, it is found that the business has possibilities of $2,660,000 annual sales if full plant capacity is utilized and the possible profits are $466,000 or 17½ per cent on sales.

Increase in Sales Required to Justify a Given Plant Expansion

When the problem of plant enlargement arises, it is worth while inquiring into the question of the increase in sales required to justify the additional capital invested. The chief effect of the plant enlargement, as far as the cost characteristics of the business are concerned, is the raising of the line of constant cost, since the additional plant facilities provided incur additional fixed charges, such as insurance, taxes, depreciation, maintenance, etc. Assume that a given business operating at full capacity has annual sales of $2,400,000, constant costs of $800,000 and variable costs at full capacity of $1,200,000. The profits at full capacity are $400,000. It is enlarged 30 per cent, with a consequent increase in fixed charges or constant costs of $200,000. The effect of this increase in constant

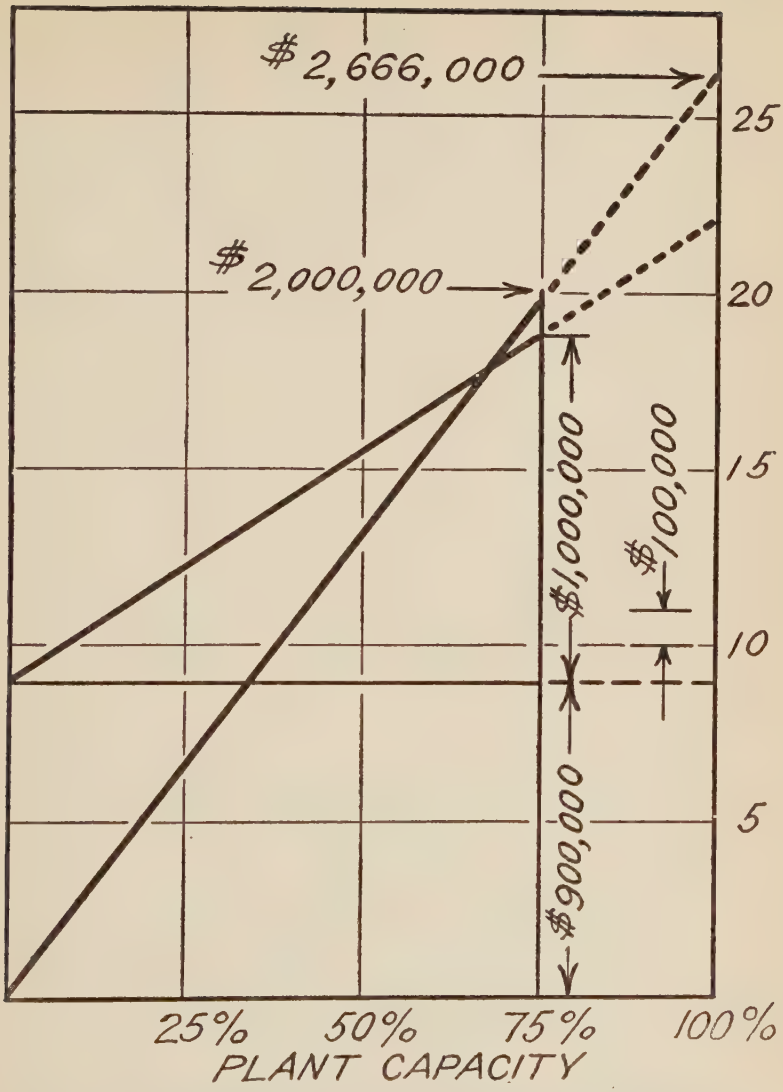

FIG. 11. THE BREAK-EVEN CHART APPLIED TO DETERMINING THE MAXIMUM EARNING CAPACITY OF A BUSINESS

costs is shown in Fig. 12. The constant cost line *CD*, which obtained for the original business, will now be raised to *C'D'*, and the variable cost line will begin at *C'* instead of at *C*, and is shown as *C'E'*. When the profit ordinate between *C'E'* and *AB'* stands at $400,000 it will be found to correspond to annual sales of $2,840,000. Therefore, in order to justify the 30 per cent addition to plant there must be a reasonable possibility of a sales increase of $440,000 or about 18 per cent of original capacity.

An examination of the chart will also show that the break-even point of the business has been raised. Whereas, formerly the break-even point was at approximately $1,600,000 annual sales, with the enlarged plant it is at approximately $2,000,000 annual sales.

When an increase in manufacturing facilities is made during a boom period and it is found that the company cannot maintain its position in sales after this period is past, it is quite evident that the company has overexpanded and is in a reverse position. There were many examples of the results of this policy during the World War period, and many businesses were brought to grief on this account. The same problem is encountered when a company enlarges its plant to take care of a single customer who has placed a large volume of business with the company and the customer discontinues placing his business with the company after a period of time.

This is always a hazardous undertaking and should be entered into with great care, such as providing a long-term contract and the assurance of the stability of the

customer's business enterprise. It is much safer to invest money in increased plant facilities as a result of the business extending its sales to a larger number of customers than to a very few. In fact, any business is in a hazardous position when a large volume of its sales is to one customer. Such a customer is always in a position to demand a price reduction on the threat of withdrawing his custom. Some automobile-accessory manufacturers have been ruined through such circumstances.

Variation of Unit Cost with Output

The unit cost of product varies with the rate of production and is determined in the following manner. We will choose for illustration the case of a beet-sugar company. The cost of manufacturing sugar from sugar beets is dependent upon the tons of beets sliced during the campaign (sugar-beet factories operate from October to January) in relation to the plant capacity, the sugar content of the beets, the amount of sugar extracted, the revenue from pulp and molasses credited to operation, as well as upon the cost of power, of farm labor and of plant labor, and administration and other expenses.

Let us assume, for example, the following conditions: A crop of 200,000 tons of beets paid for, a sugar content of $14\frac{1}{2}$ per cent, an extraction of 85 per cent after allowing for 6 per cent shrinkage; 1 ton of beets to yield 100 pounds (5 per cent) of dried pulp and 32 pounds (1.6 per cent) of molasses.

Selling price of sugar equals 6 cents per pound.

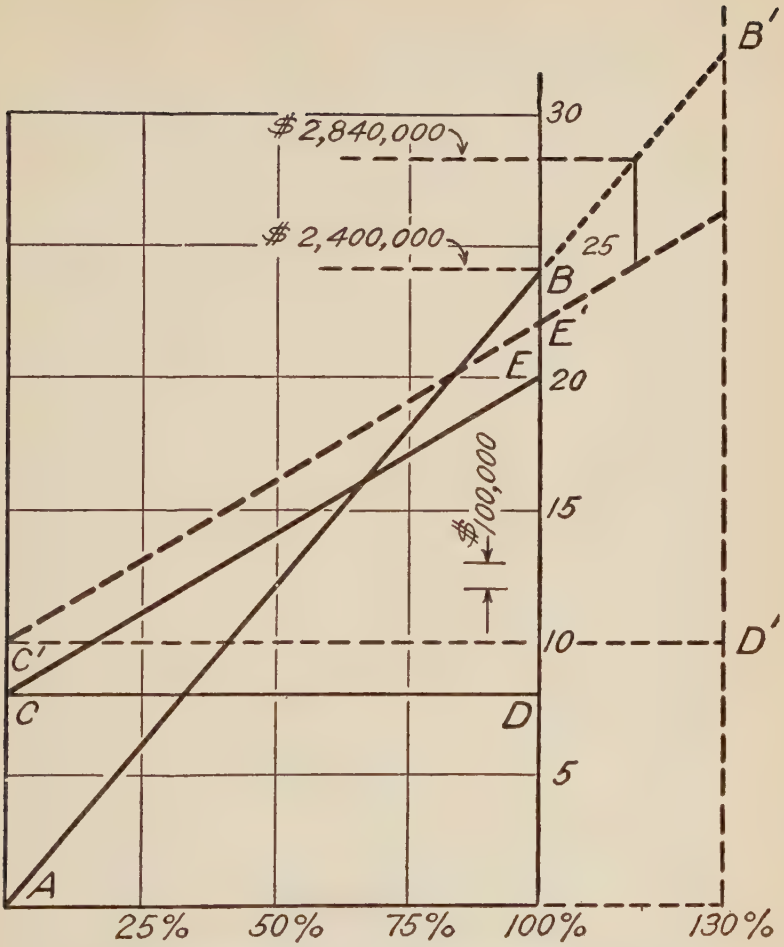

Fig. 12. The Break-Even Chart Applied to Determining the Increase in Sales Required to Justify a Given Plant Expansion

Selling price of molasses equals $8 per ton.

Selling price of dried pulp equals $30 per ton.

The amount of sugar packed from 1 ton of beets will be $(2{,}000 \times 0.94)\ 0.85 \times 0.145 = 232$ pounds. The growers are paid 45 per cent of the selling price, with a minimum guarantee of $5.22 per ton for $14\frac{1}{2}$ per cent sugar and 85 per cent extraction. Accordingly, the beets will cost the mill owner $232 \times 6 \times 0.45 = \$6.26$ per ton, and the total cost will be $200{,}000 \times 6.26 = \$1{,}252{,}500$. The total production of the plant will be:

$232 \times 200{,}000$	=	46,400,000 pounds of sugar.
$200{,}000 \times 5$ per cent	=	10,000 tons of dried pulp.
$200{,}000 \times 1.6$ per cent	=	3,200 tons of molasses.

The annual revenue from this production will be:

Sugar	46,400,000 × $ 0.06	=	$2,784,000
Molasses	3,200 × $ 8	=	25,600
Dried Pulp	10,000 × $30	=	300,000
Total			$3,109,600

The costs of operation are:

Constant costs (not varying with tonnage):	
Agricultural	$ 175,000
Depreciation of agricultural equipment	15,000
Maintenance and repair	125,000
Depreciation (factory)	125,000
Factory and administrative expense	675,000
Total	$1,115,000

Variable costs:

Freight and cartage	$ 231,750
Unloading	15,000
Packing	1,000
Total	$ 247,750

The company has bonds outstanding to the amount of $1,500,000 at 7 per cent, and therefore the company carries an annual fixed charge of $105,000.

With these data, the chart shown in Fig. 13 is constructed. It is found that the business breaks even when slightly over 150,000 tons of beets are sliced and sugar sells at 6 cents per pound. If the ordinates to the total cost line, plus bond interest, less the revenue from the by-products, is divided by the number of pounds of sugar corresponding, the cost per pound of sugar at different plant capacities utilized is determined. In this calculation it will be noted that revenues from by-products (molasses and pulp) is credited to sugar operations. For example, the total cost plus bond interest for 200,000 tons of beets is $2,701,750. The revenue from the by-products is $325,600. Crediting this revenue to operations, there results a net total cost of sugar of $2,701,750 — $325,600 = $2,376,150. Since each ton of beets produces 232 pounds of sugar, there are 46,400,000 pounds of sugar produced and the net cost is $\frac{2,376,150}{46,400,000} = \$0.0512$ or 5.12 cents per pound. In this manner the ordinates to the curve in the upper portion of Fig. 13 are determined.

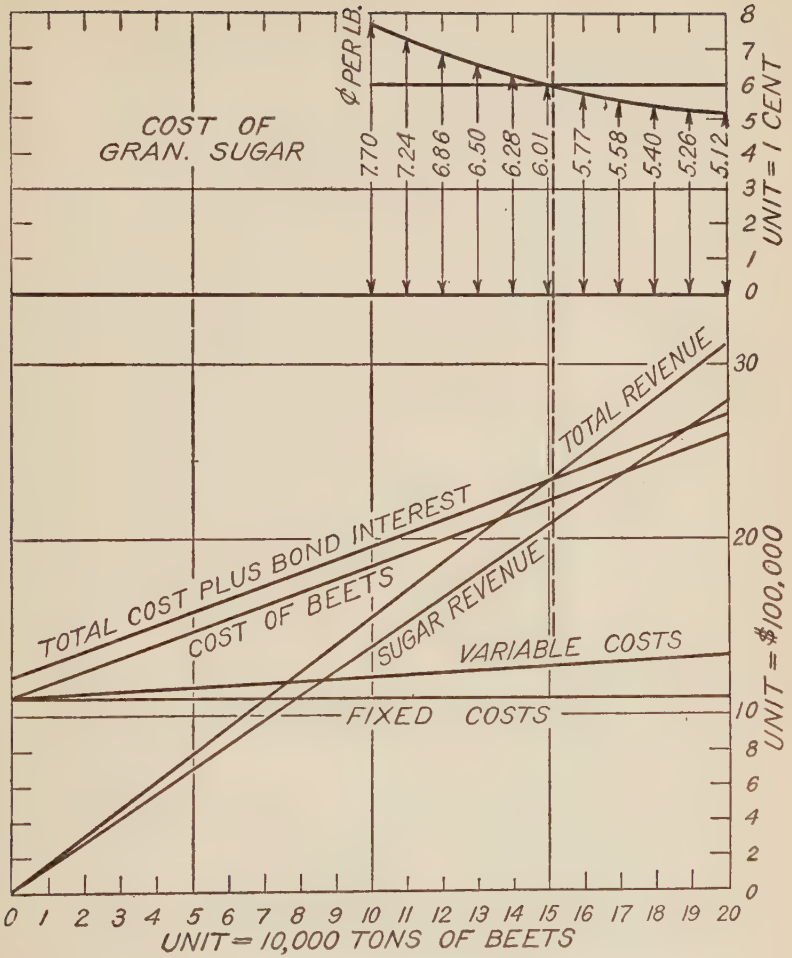

FIG. 13. VARIATION OF UNIT COST WITH OUTPUT AS APPLIED TO A BEET SUGAR MILL

It is interesting to observe in Fig. 13 that the profits of the business are largely derived from the by-products. The success of the business is largely dependent upon developing a favorable market for its by-products.

To what use can a curve of unit cost of product at varying rates of production be put? In the first place, the effect of a change in selling price per pound of product can readily be observed. In the next place, the price at which new business can be taken to effect increase in production can be quickly determined.

A certain manufacturer in Massachusetts found that the total unit cost of his product varied with volume of production as shown in Fig. 14. The plant was running at 60 per cent capacity, producing units at a cost of $8.80 per piece, which were selling at $10 per piece and yielding a profit of $1.20 per piece. This situation is shown at *A*, Fig. 14. He found that he could develop a foreign business if he could offer his goods at a price lower than his cost of production. At first this did not seem sensible. A study of the situation, however, showed that if he increased his business by 16 per cent or to 70 per cent of plant capacity as shown at *B*, he could afford to sell his product abroad for $1 below his then cost of production and nearly double the profits on his domestic business. The writer at one time managed a business which manufactured an intermediate food product, selling direct to other manufacturers. He found that the curve of unit costs was of great help in visualizing the general effect on the profits of the business if special discounts to new customers, taking a large volume of product, were offered.

Variation of Factory Expense with Output

Many business enterprises encounter difficulties when prices are based on cost determinations which assume that factory expense is a constant percentage of direct-labor cost, regardless of output and sales.

Figure 15 is the "break-even" chart for a business having an annual capacity of $1,300,000 sales. When the plant output is 85 per cent of capacity it appears that the following costs obtain:

Fixed administration and selling expense	$200,000
Fixed factory expense	200,000
Variable factory expense	170,000
Labor cost	340,000
Maintenance cost	430,000
Total	$1,340,000
Plant output sold	$1,530,000
Profit	190,000

The factory-expense total is $370,000, which is at the rate of 109 per cent, approximately, on direct-labor cost. An examination of the chart will show that at 100 per cent output the total factory expense is $400,000 and direct-labor cost is $400,000, and therefore the factory expense is 100 per cent on direct labor. At 60 per cent output, it is seen that total factory expense is $320,000, while direct-labor cost is $240,000, hence factory expense is $133\frac{1}{3}$ per cent on labor. The determination of

costs, therefore, must not be based on a constant percentage for factory expense but must be determined on the basis of plant capacity utilized. The variation of factory expense as a percentage on direct labor is shown by the curve in the upper part of Fig. 15.

Variations of Profits as a Percentage of Sales

If the profits on sales at different plant outputs are computed for the conditions shown in Fig. 15, they will be found to vary as shown by the curve marked " per cent of profit on sales." It may be convenient to express profits in terms of cents per pound or dollars per unit, and by charting profits on this basis with varying plant output, an accurate basis for determining the conditions under which it would be profitable to book additional business may be determined.

A Break-Even Chart for Each Product Manufactured

When a company is engaged in the business of manufacturing several kinds of products in the same plant, it is highly important that a " break-even " chart and unit-cost curves derived therefrom be constructed for each kind of product. This can be accomplished by an examination of the items of factory expense and apportioning each item to products made. These apportionments may be made on the basis of floor space

occupied, amount of engineering service required, and other factors which will appear when the study is made.

The writer once managed a business which manufactured five different products. The break-even chart applicable to each product was constructed, from which it was determined that the sales per day of each product required for each to break even was:

	per day
Product A	$5,000
Product B	1,300
Product C	6,300
Product D	1,200
Product E	1,200

Then the requirements of each product could be conveniently dealt with.

Increase in Total Sales Required to Balance a Given Reduction in Selling Price

The business to which the break-even chart of Fig. 15 relates produces a product which sells for 20 cents per pound. The total plant capacity is 9,000,000 pounds annually, which when sold gives an income of $1,800,000. If the profits of the business at different plant outputs, as found by the chart, are divided by the output in pounds corresponding, the results will appear as shown in Fig. 16. At full-capacity operation, the profits per pound are 3.3 cents. At 75 per cent capacity operation, the profits are 1.84 cents per pound, while at 50 per cent

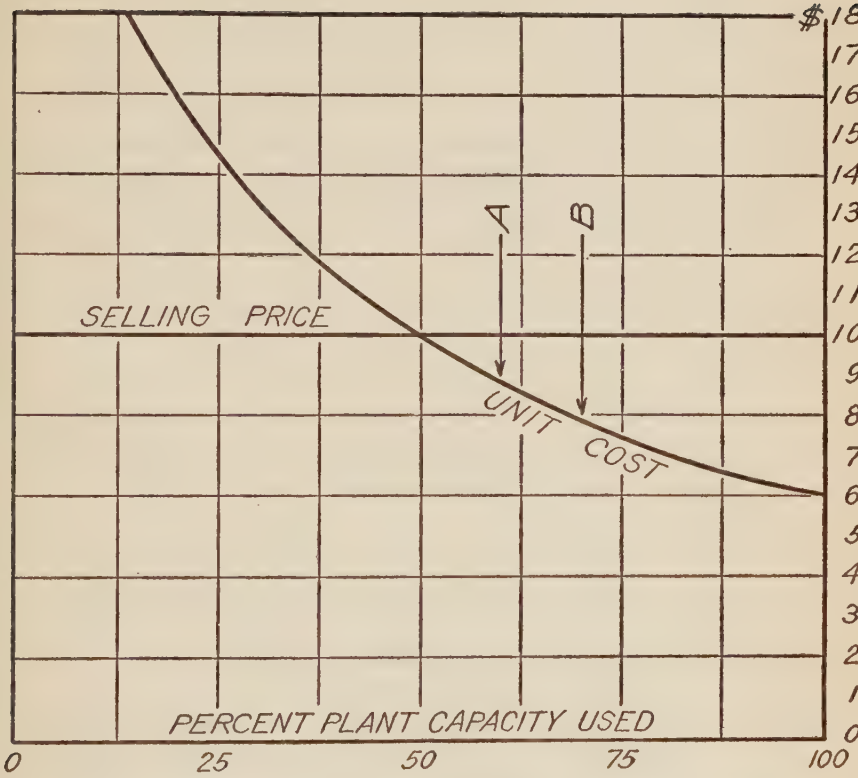

FIG. 14. VARIATION OF UNIT COST WITH OUTPUT ABOVE AND BELOW THE BREAK-EVEN POINT

capacity operation, the loss is 1 cent per pound. Assume that the plant is running at 75 per cent capacity and there is a price reduction in the trade of 1 cent per pound. The profit per pound at 75 per cent capacity and average selling price (20 cents) is 1.8 cents. Sales would have to be increased to a point which would yield 2.8 cents per pound at normal prices if a profit of 1.8 cents per pound is to be maintained at reduced prices. This takes place at approximately 90 per cent capacity. That is, the business would have to be increased from 6,750,000 pounds annual sales (at 75 per cent capacity) to 8,100,000 pounds annual sales (at 90 per cent capacity) to offset the price reduction.

The Effect of Reducing Expenses when Business Declines

Very frequently a business is tending toward a loss which is not discovered until the statements of the accounting department are prepared some time after the fact. These " post mortems " may tell the story but it would be more helpful in avoiding the situation if means were at hand for foretelling this probability and steps were taken to remedy the situation before losses occur. Assume, for example, a business having the characteristics shown in Fig. 17. If sales are normally at 85 per cent capacity or $1,530,000 annually, the business shows a profit of $230,000. Due to an agricultural depression, or the loss of some large customer, or for any other reason the sales drop to the rate of $1,200,000 annually, the business is nearing the break-even point, and some-

thing must be done if profits are still to be earned. In the first place, a chart such as shown in Fig. 17, when in use shows at once that conditions are serious and action must be taken. The only action to take, of course, is to reduce expenses. It is at such times as these that caution must be exercised against something foolish being done. Frequently a cut in labor wages is resorted to. This is not usually advisable, since it is not always effective in lowering costs because of its effect on the rate and quality of production. The most reliable remedy is to reduce overhead. Each business possesses its own possibilities in this regard and any competent manager having complete statistical information of the business will soon find ways and means for accomplishing this result. Should, for example, the fixed costs be cut by $100,000 when sales reached 65 per cent of plant capacity, the results will be as shown by the dotted line in the chart Fig. 17. The business will have a lower break-even point (55 per cent), and the possibilities of profit will be extended. Records such as these give ample warning beforehand which, of course, is one of their chief values. The elimination of this " element of surprise " in business must constantly be striven for.

Several Laws

The graphic analysis of business enterprise — given in the foregoing pages — is a useful instrument for determining the general economic relationships in any given business, and is one of the best means available for visualizing the business. It also permits of the formu-

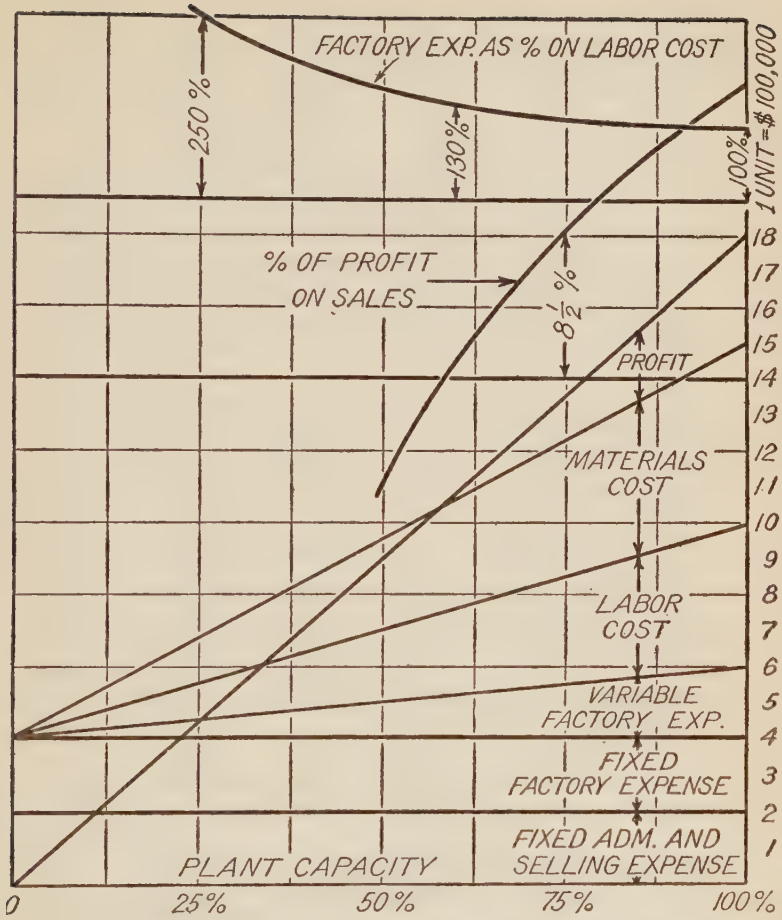

FIG. 15. VARIATION OF FACTORY EXPENSE AND PER CENT OF PROFIT ON SALES WITH OUTPUT

lation of some general laws which are useful in forecasting probabilities.

It was shown on page 108 how the law of vanishing profits is determined. For the sake of convenience, it is repeated here.

1. The profits of the business will vanish when

$$\text{Sales} = \frac{\text{constant total costs}}{1 - \dfrac{\text{variable total costs}}{\text{corresponding sales}}}.$$

2. *The law of profits* for a given business may be found in like manner, and is

$$\text{Profit} = x(1 - b) - a$$

where

x = estimated sales

$b = \dfrac{\text{variable total costs}}{\text{corresponding sales}}$.

a = constant total costs.

3. *The law of profits as a percentage of sales is*

$$\text{Percentage profit} = 1 - b - \frac{a}{x}$$

4. *The law of factory expense* as a function of plant capacity utilized, in terms of direct-labor cost is

$$\text{Factory expense} = \frac{Fc + Vx}{Lx},$$

where

Fc = constant factory expense.

$$V = \frac{\text{variable factory expense}}{\text{corresponding output (dollars)}}.$$

$$L = \frac{\text{direct-labor cost}}{\text{corresponding output (dollars)}}.$$

$x =$ estimated output (dollars) for which factory expense is to be determined.

5. *The law of cost per unit of product* is

$$\text{Unit cost} = bu + \frac{au}{x}$$

where

$$b = \frac{\text{variable total costs}}{\text{corresponding sales}}.$$

$a =$ constant total costs.
$u =$ unit selling price.
$x =$ estimated output in dollars.

Some General Observations Concerning the Economic Characteristics of a Business

The foregoing statements concerning the economic characteristics of a business relate to conditions obtaining at a particular time in the history of the business. But it must be remembered that business conditions are always changing. Today the price of copper, for example, is up 4 cents per pound, from a steady price not varying more than $1\frac{1}{2}$ cents for a period of years. Again a new method of processing may be adopted that

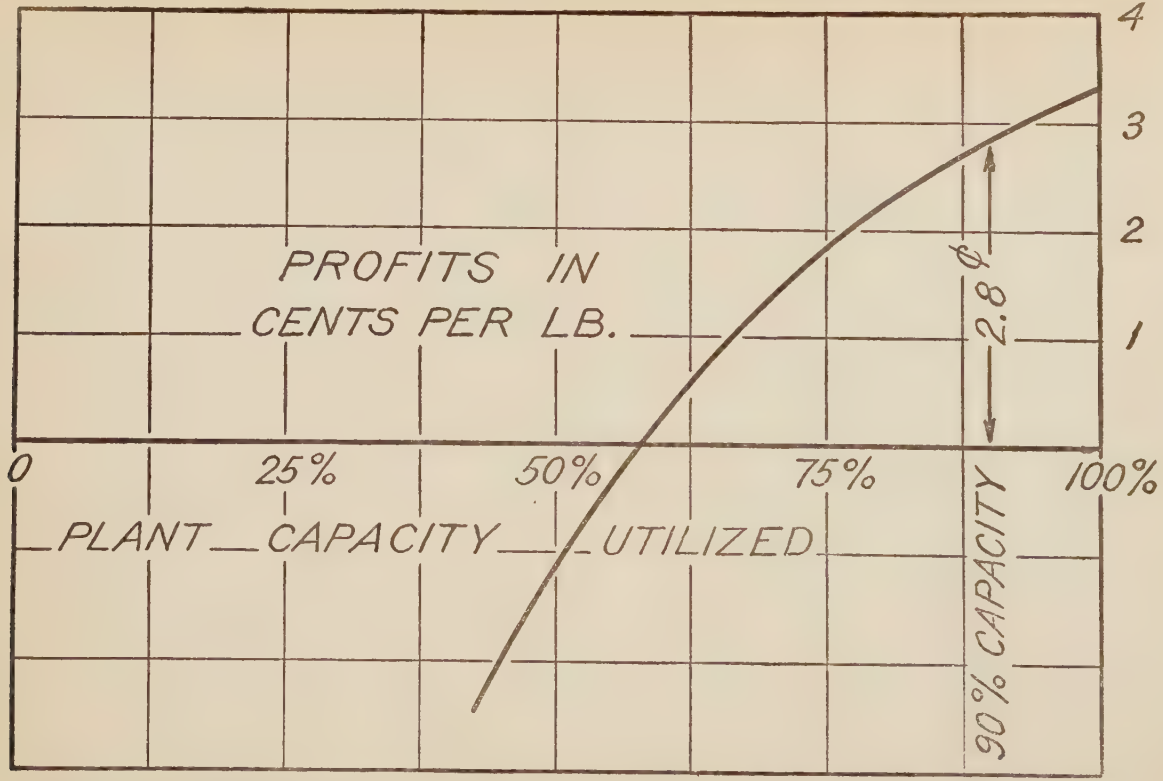

FIG. 16. CHART FOR DETERMINING THE INCREASE IN SALES REQUIRED TO BALANCE THE EFFECT OF A GIVEN REDUCTION IN SELLING PRICE

changes operating costs, or a new designing engineer may be employed and he finds short cuts in manufacturing which save materials and labor costs. Or a works manager does not keep to standard, and inefficiencies creep into the various sections of the shop and costs of manufacture rise. Markets vary. The general public goes to the movies or listens in on the radio and the piano business is affected and not as many pianos are sold. But people sit up later to listen to the radio and the lighting bill of the country goes up. Women wear shorter skirts and the dress goods business is affected. Shorter skirts demand silk stockings and the business of manufacturing stockings improves. The style changes from open cars to closed cars and the celluloid business is not so good because celluloid was used for the side curtains of open cars. And thus any number of examples may be cited to illustrate the ever-changing conditions in business.

Costs of manufacture, costs of merchandising, the relation of fixed charges to variable costs, the relation of labor cost to factory expense are not constant for any business. They may not change much for a period of time but they do change. Hence, a break-even chart, and profit analyses, and unit-cost curves should be made periodically and checked with results. In general, a 6-month time period will be adequate, but this generalization is like many other generalizations in that it may not fit a particular case. It is believed, however, that the wholesome effect of making such an analysis every 6 months will more than repay for the slight effort required.

The redesign of products with reference to interchangeability of parts, adaptability to the same processing equipment, the reduction of times of processing, and the substitution of less costly materials for expensive materials will affect the variable total cost particularly. Labor costs and material costs will generally be lowered, although some of the constant total costs will also generally be lowered. It must be remembered that the term " constant " is used in the sense that the costs are fixed by policy or operating conditions. Salaries paid are matters of executive policy. The amount of fixed charge in respect of power used is determined by the limitations of the processes employed. What is constant for one set of conditions will not be constant for another set of conditions.

Estimates of costs on the basis of new designs may be used in constructing a new break-even chart and thus the general results may be determined quantitatively.

New and improved methods of manufacture by the use of new facilities will affect labor cost and under some conditions may affect materials costs and fixed charges. The results of any contemplated changes in manufacturing facilities may readily be disclosed through the construction of a break-even chart and its comparison with the break-even chart applicable to the older facilities. It is always well to realize that the adoption of improvements will depend to some extent on an ability to prove the case. That is to state, the engineer generally accomplishes his work by working with and through people. The manager must prove to the board of directors that a certain proposed investment in im-

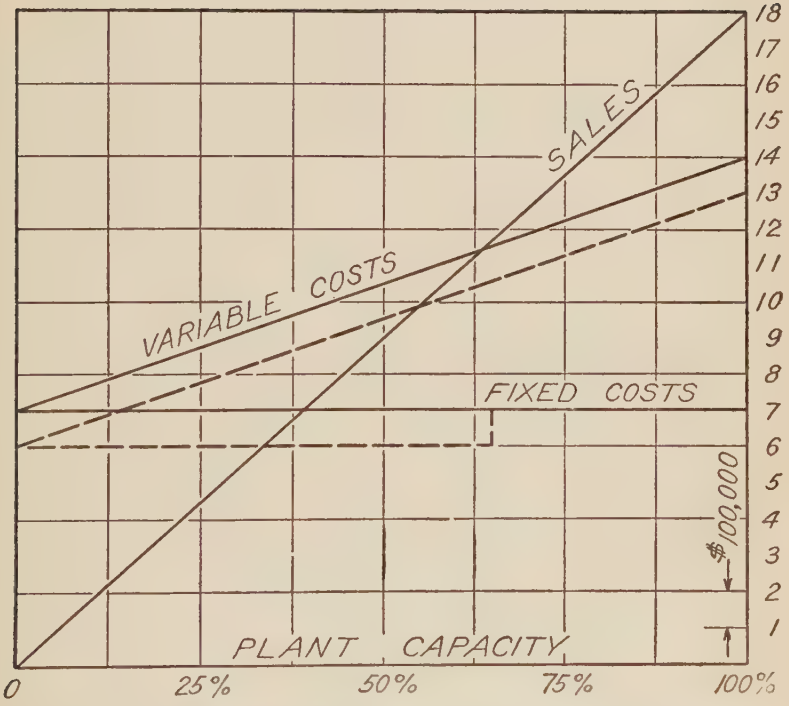

FIG. 17. CHART FOR DETERMINING THE EFFECT ON PROFITS BY REDUCING FIXED CHARGES WHEN SALES DECLINE

proved facilities will pay. The superintendent must prove to the general manager that it would pay to buy a certain boring mill and discard one of older design. Any comparative analysis in graphic form such as comparative break-even charts is usually very effective in proving such cases. But the data on which the chart is based must be absolutely correct.

It is generally impossible to be effecting improvements in design and methods of manufacture without improving the management. The same spirit which prompts the seeking of better designs and more economical processes also prompts other activities, for it is contagious. A more logical basis of commission payments to salesmen is worked out and put into effect and selling cost is reduced from 15 to 12 per cent of sales. A rearrangement of stores is effected and indirect labor in stores is reduced. Several accounting divisions are consolidated and useless data are dispensed with, resulting in accounting costs being reduced. All these changes affect the constant and variable costs of general expenses and the results may be fully shown by the break-even chart.

CHAPTER VI

THE BALANCE SHEET

CHAPTER VI

THE BALANCE SHEET

THE Balance Sheet is a financial statement of what a company owns and the form in which it exists together with what it owes and the nature of the obligations.

That which is owned is an asset and that which is owed is a liability. The Balance Sheet is, therefore, a statement of the assets and liabilities of a business.

The average business man is not trained in accounting practice and the terminology used is often confusing to him. Furthermore, a business possesses very many material things and items of an intangible nature each of which has some value — but what value in dollars and cents? is the question. This raises the question of what *value* is or what a thing is worth. The possessions of a business may be valued from the standpoint of the money which was paid to acquire them or the money which may have to be paid today to replace them, or their value from an earning standpoint and from other standpoints. The assets, subject to the liabilities, of a certain business were sold recently for two and one-half times their replacement cost — why — because the value in earnings to the competitor acquiring the business was many times the sum.

Value as a going concern, liquidation value, value for rate-making purposes as applied to public utilities are questions which arise in judging the assets and liabilities of a business.

The value of intangibles is also a complex problem. What is a patent worth? What is good will worth?

An idea in possession or control of an individual of resources and initiative is worth more to that individual or to society than if it were in the possession of another person not so competent. A plant in control of one group of people is worth more than the same plant in control of another group. What is an organization worth?

Liabilities are expressed in dollars and cents in an attempt to state the amount of money which may have to be spent or paid out in meeting certain obligations when they become due. Certain liabilities can be very definitely expressed, others cannot be. Reserves may be set up in the Balance Sheet as an expression of the probable amount of money which may have to be paid out if certain contingencies eventuate. A civil suit or patent suit is pending — what damages may be assessed if any? Perhaps such suits are pending and no reserve has been set up — does the Balance Sheet show all values of liabilities?

In general, it may be stated that the Balance Sheet of the average manufacturing enterprise from the standpoint of being of service to the management in operating the business should show the present-day replacement costs of assets and the costs of liquidation of its liabil-

ities. It should show *all* liabilities — contingent and others. The terminology of the Balance Sheet should express full meanings. One of the best forms of Balance Sheets from the standpoint of the general public is issued by the Corn Exchange Bank of New York City. It is given herewith.

October 1, 1928

DUE INDIVIDUALS, FIRMS, CORPORATIONS AND BANKS	$240,686,834.30
A conservative banker always has this indebtedness in mind, and arranges his assets so as to be able to meet any request for payment.	
For this purpose we have:	
CASH	$33,073,407.22
(Gold, Bank Notes and Specie) and with legal depositories, returnable on demand.	
CHECKS ON OTHER BANKS	11,826,918.41
Payable in one day.	
U. S. GOVERNMENT SECURITIES	67,387,193.94
LOANS TO INDIVIDUALS AND CORPORATIONS	60,705,666.52
Payable when we ask for them, secured by collateral of greater value than the loans.	
BONDS	19,046,349.48
Of railroads and other corporations, of first quality and easily salable.	
LOANS	48,077,689.82
Payable in less than three months on the average, largely secured by collateral.	
BONDS AND MORTGAGES	20,278,297.61
BANKING HOUSES	9,058,886.38
All located in New York City.	

Other Real Estate	108,500.00
Total to Meet Indebtedness	$269,562,909.38
This Leaves a Capital and Surplus of	$28,876,075.08

Which is a guarantee fund upon which we solicit new deposits and retain those which have been lodged with us for many years.

* * *

Our listed resources, enumerated in this statement, do not and cannot include those assets of friendliness and helpfulness which this bank has in the personnel of its board of directors, its officers and employees. These are assets which pay dividends to our patrons in service and satisfaction. — Balance Sheet of Corn Exchange Bank, New York City.

The balance sheet shown on page 151 may be taken as typical for a manufacturing business. It is given in condensed form for the sake of simplicity. The items may be expanded in much greater detail in order to disclose the situation more fully.

It will be noted that the Assets are listed according to three general classifications — and these are:

Current Assets which are assets in the form of cash or items which are readily convertible into cash.

Fixed Assets which are the permanent investments of the business and *Other Assets* which are generally items paid in advance. If these items are not paid in advance, no liability is incurred, and cash would be $25,000 greater.

There is no standard form of Balance Sheet in general use, but the items of Current Assets and Fixed Assets will usually be found in every Balance Sheet.

One of the principal duties of the management, as far as the supervision of financial operations is concerned, is to see that the Fixed Assets of the business, as

represented by machinery and plant equipment, are sufficient to produce and handle the requirements of the sales department, and to provide adequate Current Assets to purchase materials, meet the payroll each week,

January 1, 1930

Balance Sheet

Assets		Liabilities	
Current:		Current:	
Cash	$ 100,000	Accounts payable	$ 50,000
Account Receivable	250,000	Notes payable ..	190,000
Inventory	650,000	Accrued Items	10,000
Total	$1,000,000	Total	$ 250,000
Fixed:		Other:	
Plant	$2,500,000	Mortgage	$ 750,000
Branch Office Equipment ..	150,000	Reserves:	
Automobiles ...	250,000	Contingencies ..	$ 50,000
Investments ...	600,000		
Total	$3,500,000	Capital and Surplus:	
		Capital Stock Preferred	$1,500,000
Other:		Capital Stock Common	750,000
Unexpired Insurance	$ 10,000	Surplus	1,225,000
Prepaid Taxes ..	15,000	*Total*	$4,525,000
Total	25,000		
Total ...	$4,525,000		

maintain sufficient inventory, accommodate customers, by carrying their accounts for 30 days or more, and to discount bills promptly. The assets of the business may be likened to the defensive and offensive forces of a nation. If a country had all of its military equipment in the form of fortifications (Fixed Assets) it would have

no mobile equipment (Current Assets) with which to carry on its military operations. If all of the capital of a business is invested in plant and machinery, there are no means of providing material, labor, and services to run the plant.

The amount of Current Assets required for a given business, as well as the investment demanded in the way of Fixed Assets, will depend entirely on the nature of the business, and the volume of the sales. There is a desirable value or a limit for each item of the Balance Sheet for every business, and any departure from these limits will constitute some hazard to the business. Cash should not run below a given amount, Accounts Receivable should not run above a certain limit, Inventory should not be *more* than a stated sum or *lower* than a fixed amount. Investment in plant should not be larger than required for sales demands.

Every manager should know these limits for his particular business and direct the affairs of the business so that each item of the Balance Sheet reflects a healthy situation and does not become a source of hazard. There are three principal divisions of the Current Assets, and these are:

Cash which is composed of deposits in the bank, money in the hands of agents, petty cash, and money located at other authorized places. The writer is a firm believer in *adequate cash resources.* A carefully supervised budget of income and expenditures, which provides for the maintenance of a good cash reserve, is a very important factor in business.

Accounts Receivable, to be perfectly frank, represent

the amount by which the manufacturer is acting as a banker to his customers. Carrying customers on open account may result in quite a hazard and therefore this item should be very carefully managed.

In Europe, we are informed there is nearly three times the volume of business done for the same working capital, as is done in America, because of the fact that in Europe business is generally done through the use of trade acceptances. These acceptances are discounted at the bank as cash may be required and the banks act in their legitimate capacity of providing funds for commercial transactions. The practice of using trade acceptances in this country is gradually growing, but not as rapidly as it should.

Accounts Receivable, representing over 30 days' business indicate a too liberal credit policy. If, for example, a company does a business of $1,000,000, per month, and its Accounts Receivable are $2,000,000, it indicates that some customers have not paid their bills for 2 months and probably more and are liable to become delinquent.

Inventory represents the money value of labor, material, and factory expense accumulated in finished goods — goods in process and raw materials. Inventory is frequently given as valued at — " actual cost " or the market value, which ever is lower. What this means is that in an appraisal of assets the drop in the market price of raw materials, if any has occurred since the material was purchased, has been taken into account. In judging the value of assets, considerable care should be given to the inventory item. Very frequently the values given

are deceiving. Suppose, for example, that an inventory has been accumulated with the factory running at 25 per cent normal capacity, and resulting, for example, in a factory expense of 250 per cent on labor, while with 100 per cent factory operations the factory expense may be only 100 per cent on labor. An inventory value based on 250 per cent factory expense would not be fair. The writer recalls a very troublesome case of an appraisal in which the above situation was encountered. The management of the inventory item in the operation of any business must be conducted with care, for reasons which will be subsequently referred to.

The items of the Fixed Assets are sufficiently clear as to their meaning. Attention is called, however, to two different ways of reporting this item. It is sometimes the practice to report the original purchase price or the appraised value of the plant and equipment without deducting for depreciation each year, but carrying a depreciation reserve on the liability side of the account. Others deduct the depreciation each year and report the net value as assets. Care should be exercised in reading this item to note if adequate depreciation has been allowed.

Other Assets refers in general to those items of assets which cannot be classed as current, because they will not be soon converted into cash; nor fixed, because they are not a part of the operating equipment. The items listed in the sample Balance Sheet will disappear in the course of time.

The Liabilities are of two general kinds.

Current Liabilities are those which are now payable,

or will be due within a short period of time, of which *Accounts Payable* are bills which have been incurred and should be paid within a few days and

Notes Payable may be due in 30, 60, or 90 days, while *Accrued Items* are expenses payable at stated periods, which have accumulated to date to the amount stated. If, for example, the Balance Sheet is drawn for September 30, 1925, which is on a Wednesday and wages are paid on Friday evening, then the wages earned from Saturday to Wednesday, inclusive, are *accrued* in the Balance Sheet. In like manner taxes and insurance may be accrued.

Other Liabilities are those items on which payment is due at a distant date. A mortgage on the property may be payable in five years. However, if the terms are such that a certain portion must be paid each year to reduce the mortgage, the company may have to pay, within a few days, much more than the Current Liabilities indicate. If, for example, in the case of the Balance Sheet given in illustration, the date is September 30, 1925, and a payment of $200,000 is due on the mortgage on October 15, 1925, the current obligations of the business are in reality $500,000. A Balance Sheet is more illuminating when dates of next payment on mortgage and amount due are given.

Reserves are for contingent liabilities. The amount of the reserve is set up out of surplus. When a reserve is set up, a certain amount of cash should be also set aside to meet it, the amount depending upon the time of probable payment and the relative demands for cash for other requirements. A reserve does not mean any-

thing unless adequate cash is available to meet the situation expected. Simply transferring a value from one heading to another in a statement does not provide the funds.

Capital stock consists in general of two classes: Preferred and common. These are items due to stockholders and payable, subject to certain prior rights, upon liquidation of the business.

Preferred stock is so termed because it is preferred as to earnings and may be as to assets. That is, dividends on the preferred stock are paid before the common, and if the stock is cumulative, this payment is obligatory. If there are any earnings remaining after the preferred dividend, then the directors *may* declare a dividend on the common. Preferred stock participates in the dividends at a fixed rate usually 7 or 8 per cent, while the common stock bears no fixed rate of dividends, and therefore may receive from, say, 6 to 30 per cent, or even 100 per cent or more per annum, depending on the prosperity of the company and on the policy of the directors.

Dividends are payable from surplus only and not from earnings. A company may have a deficit for the year 1923, amounting to $750,000. If earnings in 1924 are $500,000, no dividend can be declared, because there will still be a deficit of $250,000. This limit to the powers of the directors is fixed by law.

Preferred stock may be preferred over the *common* stock upon liquidation of the business. That is, if the debts of the company are paid, and the assets sold, the preferred stockholders are paid off to the face value of

their stock before the common stockholders share in the proceeds. If the proceeds are not large in proportion to the outstanding stock, then the preferred stockholders may receive a pro rata share of the proceeds and the common stockholders none.

Surplus is the difference between the total assets and the liabilities, exclusive of surplus. If in the sample Balance Sheet given on page 151, the total assets were converted into cash, and all the Current Liabilities paid, mortgage paid, and all stock, preferred and common, retired at par, then the common stockholders still have $1,225,000 due them. Surplus does not represent cash, but is an amount established by definition.

The sum of the capital stock (preferred and common) and the surplus is known as the *Net Worth* of the business. In the example given the Net Worth of the business is $3,475,000 and represents the amount that the stockholders have at the risk of the business. The *debts* of the business in the above example are $1,050,000, and represent the amount which the creditors have at the risk of the business.

The total amount which the stockholders provide plus what the creditors provide constitutes the Total Assets of the business.

There are, therefore, two groups of interests which provide capital to operate a business — the stockholders and the creditors. The creditors are also of two classes, *i.e.*, those whose accounts must be paid within a short time, and those whose accounts are payable over a period of years. The short-term creditors are generally merchandise creditors, banks, and note holders, while the

long-term creditors are generally those who hold mortgages or bonds.

The management of the finances of a business must be so conducted that there are always sufficient funds on hand to meet these obligations. Accounts Receivable must be turned into cash in anticipation of maturing obligations. If current bills are not paid on time, the credit of the organization is impaired and a serious handicap is placed on the conduct of the business.

When Accounts Receivable are not collectible — due to a general business depression — the assets of the company are said to be " frozen." Creditors press their claims and the company may be forced into bankruptcy or a receivership to protect its assets. The same situation arises when mortgages must be met and no funds are available to meet them. This condition is very frequently due to poor financial management, in which investments are made in plant extensions to provide improvements or in anticipation of new business, and the new business never materializes. Sometimes large purchases of raw materials are made well in advance of immediate requirements and the bills for these materials must be met before they can be converted into goods and sold. The market has been misjudged and if bank loans cannot be made to tide over the situation, the company is liable to become embarrassed.

The *working capital* of a company consists of the Current Assets less the Current Liabilities. In the example given, the working capital is $750,000. In making this determination, it is well to include bank loans, if any,

in the Current Liabilities. While banks generally will renew a note upon payment of an amount on the principal, it is generally the case that the bank will require the borrower to be " off its books " at least once a year. Furthermore, since the bank must be careful not to extend itself, it may be forced to call a loan or demand payment upon maturity. Therefore, it is well to assume that bank loans are Current Liabilities to be paid within a short period of time.

Analysis of the Balance Sheet

The Balance Sheet of a company discloses certain characteristics of the business and may indicate the character of the management. These disclosures are made by comparing the ratios of certain items of the Balance Sheet with more or less recognized standards. These standards are different for different kinds of businesses, but this fact is not always recognized, and much work must be done on this subject before generally accepted standards for different kinds of businesses will be accepted.

The ratios which are generally applied in analyzing a Balance Sheet and certain items from the operating or Profit and Loss Statement are as shown on the next page.

To illustrate the application of these ratios, and their interpretation to particular businesses, we will give three examples which were published in the Annalist, a supplement of the New York *Times,* on May 2, 1921. See pages 161, 162, 163.

	Ratio		*To Show*
1.	Current Assets / Current Liabilities	=	Degree of liquidity.
2.	Reserve / Total Assets	=	Degree of conservatism.
3.	Cash / Current Liabilities	=	Cash position.
4.	Total Assets / Net Worth	=	Apportionment of stockholders interest.
5.	Receivables / Annual Sales	=	Collection policy.
6.	Inventory / Annual Sales	=	Size of inventory.
7.	Sales / Net Worth	=	Activity of stockholders interest.
8.	Debt / Net Worth	=	Relation between money interests of creditors and that of stockholders.
9.	Annual Sales / Fixed Assets	=	Vitality of Fixed Assets.
10.	Profit or Loss / Capitalization	=	Degree of profitableness of the business.

EXAMPLE NO. 1

LARGE AND POPULAR TIRE CO.; BALANCE SHEET OCT. 31, 1920

	ANALYSIS		ACTUAL CONDITION	DESIRABLE LIMITS	COMMENT
1	CURRENT ASSETS CURRENT LIABILITIES	= $ 65,895,193 = 49,806,494	= 132%	200%	This signifies that there is but $1.32 of Current Assets for every $1.00 of Current Liabilities. There should be at least $2.00 of Current Assets for every $1.00 of Current Liabilities.
2	RESERVES TOTAL ASSETS	= 1,716,575 = 169,012,832	= 1%	3%	This indicates that there is only 1c. of Reserves for every $1.00 of Total Assets. Conservatism would demand at least 3c. of Reserves for every $1.00 of Total Assets.
3	CASH CURRENT LIABILITIES	= 2,178,509 = 49,806,494	= 4%	25%	This denotes there is 4c. of Cash on hand for every $1.00 of Current Liabilities. This is a very weak cash position. There should be at least 25c. of Cash on hand for every $1.00 of Current Liabilities.
4	FIXED ASSETS NET WORTH	= 103,117,639 = 111,597,519	= 92%	50%	This shows that there is 92c. of Fixed Assets for every $1.00 of Net Worth.
5	RECEIVABLES SALES	= 12,519,035 = 188,866,024	= 6%	10%	This registers that the Receivables on hand amount to 6c. per $1.00 of Sales, and also that the Receivables equal 22 days' business. Both of these elements indicate a good state of collectivity. There should never be more than 10c. of Receivables for every $1.00 of Sales.
6	MERCHANDISE SALES	= 51,197,649 = 188,866,024	= 27%	30%	This indicates 27c. of Merchandise on hand for every $1.00 of Sales; Merchandise equals about 90 days of business, and a merchandise turnover of about 4 times per annum. This is normal showing. Merchandise should not run over 30c. per $1.00 of Sales.
7	SALES NET WORTH	= 188,866,024 = 111,597,519	= 169%	200%	This reflects there was $1.69 of Sales for every $1.00 of Net Worth. This is very sluggish. There should be at least $2.00 of Sales per $1.00 of Net Worth (Stockholders' interest).
8	DEBT NET WORTH	= 55,698,000 = 111,597,519	= 49%	30%	This points to there being 49c. of Debt for every $1.00 of Net Worth (Stockholders' investment). There should not be more than 30c. of Debt for every $1.00 of Net Worth.
9	SALES FIXED ASSETS	= 188,866,024 = 103,117,639	= 182%	300%	This signifies there was $1.82 of Sales for every $1.00 of Fixed Assets. This is much too small; there should be at least $3.00 of Sales for every $1.00 of Fixed Assets. Volume of sales does not make the Plant investment worth while.
10	DEFICIT CAPITALIZATION	= 2,046,731 = 132,050,000	= 1½%	15%	The operations of company were conducted at a loss equal to 1½c. on every $1.00 of Capitalization. Normal profits should have been at least 15c. on each $1.00 of Capitalization.

SUMMARY

The above analysis discloses the following:

Danger Points.

1. A poor business balance.
2. Lack of conservative reserves.
3. Poor cash position.
4. Too heavy investment in plant.
7. Subnormal activity of invested funds.
8. Bad balance between capital invested and capital secured by loans.
9. This, together with No. 4, shows that plant has been enlarged more rapidly than net worth (Stockholders' interest), and also that sales activity is not keeping pace with the increase in size of plant.
10. Business operated at a loss instead of a profit.

Normal Points.

5. Efficient collection policy.
6. Turnover of merchandise is active enough and is proportionate.

The above analysis shows a precarious financial condition; there is need for immediate intelligent correction if this company is to be saved from reorganization or worse.

EXAMPLE NO. 2

LARGE AND WELL-KNOWN REFRIGERATOR CO.; BALANCE SHEET AUG. 31, 1920

	ANALYSIS			ACTUAL CONDITION	DESIRABLE LIMITS	COMMENT
1	CURRENT ASSETS CURRENT LIABILITIES	= $1,077,187 = 606,430	=	178%	300%	Indicates there is $1.78 of Current Assets for every $1.00 of Current Liabilities. There should be at least $3.00 of Current Assets for every $1.00 of Current Liabilities.
2	RESERVES TOTAL ASSETS	= ..... = 2,395,036	=	...		This shows a glaring unprotected Reserve condition, and is a strong indication of inferior financial ability. There should be at least 5c. of Reserves for every $1.00 of Total Assets.
3	CASH CURRENT LIABILITIES	= 45,737 = 606,430	=	7%	25%	Evidences there is 7c. of Cash for every $1.00 of Current Liabilities. This is poor showing of Cash status. There should be at least 25c. of Cash for every $1.00 of Current Liabilities.
4	FIXED ASSETS NET WORTH	= 1,317,849 = 1,170,463	=	113%	60%	Signifies there is $1.13 of Fixed Assets per $1.00 of Net Worth.
5	RECEIVABLES SALES	= 244,260 = 1,488,538	=	16%	20%	Reflects there is 16c. of Receivables on hand for every $1.00 of Sales; same equals about 60 days of business. This is a normal collection showing. There should not be more than 20c. of Receivables per $1.00 of Sales.
6	MERCHANDISE SALES	= 787,190 = 1,488,538	=	52%	40%	This shows that there is 52c. of Merchandise for every $1.00 of Sales; same equals 189 days of business, and a merchandise turnover of about 2 times per annum. This is too large an inventory status. There should not be more than 40c. of Merchandise for every $1.00 of Sales.
7	SALES NET WORTH	= 1,488,538 = 1,170,436	=	127%	300%	Denotes there was $1.27 of Sales for every $1.00 of Net Worth (stockholders' interest). This is a striking case of "dry rot," and a very overextended condition. There should be at least $3.00 of Sales for every $1.00 of Net Worth.
8	DEBT NET WORTH	= 1,224,600 = 1,170,436	=	104%	30%	Registers there is $1.04 of Debt for every $1.00 of Net Worth (stockholders' investment). This means that the Creditors have a greater interest by 4c. than the legal owners. There should not be over 30c. of Debt to every $1.00 of Net Worth.
9	SALES FIXED ASSETS	= 1,488,538 = 1,317,849	=	113%	400%	Indicates there was $1.13 of Sales for every $1.00 of Fixed Assets. This is much too small. There should be at least $4.00 of Sales for every $1.00 of Fixed Assets. Viewed with No. 4, it shows that sales productivity does not warrant size of plant.
10	PROFIT CAPITALIZATION	= 135,509 = 1,788,000	=	8%	15%	Shows that only 8c. per $1.00 of Capitalization was earned for the year. This should have amounted to at least 15c. per $1.00 of Capitalization.

SUMMARY

The above analysis shows the following result:

Danger Points.

1. Poor liquidity status.
2. Absence of reserves.
3. Weak cash position.
4. A too heavy investment in fixed assets compared with amount of stockholders' investment.
6. Merchandise on hand is abnormal, and turnover of same is too small.
7. Vitality of the money investment is very sluggish.
8. Funds controlled by creditors are greater than money investment of stockholders.
9. Sales activity does not warrant plant investment, and, considered with No. 4, points to an overextended status.
10. Profits are much below a profitable return.

Normal Point.

5. Good collection policy.

This business is not far from so-called "financial rocks." It has all the "ear-marks" of incompetent old-fashioned management. Here is an example of a company that would be practically impossible to rejuvenate.

EXAMPLE NO. 3

Old and Well-established Mail Order House; Balance Sheet Dec. 31, 1920

	Analysis			Actual Condition	Desirable Limits	Comment
1	Current Assets Current Liabilities	= $163,531,811 = 73,180,074	=	223%	250%	Signifies there is $2.23 of Current Assets for every $1.00 of Current Liabilities. There should be at least $2.50 of Current Assets for every $1.00 of Current Liabilities in view of quality of Current Assets and character of clientele.
2	Reserves Total Assets	= 3,423,749 = 230,668,197	=	1%	3%	Indicates there is 1c. of Reserves for each $1.00 of Total Assets. There should be at least 3c. of Reserves for each $1.00 of Total Assets for a sound showing.
3	Cash Current Liabilities	= 3,263,353 = 73,180,074	=	4%	25%	Points to Cash of 4c. for every $1.00 of Current Liabilities. This is very weak Cash condition. There should be at least 25c. of Cash for every $1.00 of Current Liabilities.
4	Fixed Assets Net Worth	= 67,136,385 = 90,554,374	=	74%	60%	Registers that there is 74c. of Fixed Assets for every $1.00 of Net Worth.
5	Receivables Sales	= 47,797,134 = 233,856,872	=	20%	30%	This means that there are 20c. of Receivables on hand for every $1.00 of Sales, Receivables amounting to 72 days' business. There should not be more than 30c. of Receivables for every $1.00 of Sales in this class of business.
6	Merchandise Sales	= 105,071,243 = 233,856,872	=	45%	25%	This points to their being 45c. of Merchandise on hand for every $1.00 of Sales; it equals 162 days of business, and an annual turnover of a little more than two times. This is too heavy an Inventory. There should not be more than 25c. of Merchandise for every $1.00 of Sales, which would equal 90 days' business, and a turnover per year of about four times.
7	Sales Net Worth	= 233,856,872 = 90,554,374	=	258%	300%	Reflects there was $2.58 of Sales for every $1.00 of Net Worth (stockholders' interest). To show a healthy status in this regard there should be at least $3.00 of Sales to every $1.00 of Net Worth.
8	Debt Net Worth	= 110,103,823 = 90,554,374	=	122%	60%	This points to a Debt of $1.22 for every $1.00 of Net Worth (stockholders' investment). This is a strong point of inferior financial management, showing that the creditors have a greater interest in the business by 22c. than the legal owners. There should not be over 60c. of Debt for every $1.00 of Net Worth.
9	Sales Fixed Assets	= 233,856,872 = 67,136,385	=	348%	400%	This indicates that volume of Sales amounted to $3.48 per $1.00 of Fixed Assets. It means that amount of capital invested in Fixed Assets is not warranted by the volume of Sales. Sales should at least equal $4.00 for every $1.00 of Fixed Assets.
10	Profit Capitalization	= 11,746,670 = 154,064,373	=	7%	15%	Operations of company were conducted at a profit of but 7c. for every $1.00 of Capitalization. Normal showing would call for a yield of at least 15c. of Profit for every $1.00 of Capitalization.

SUMMARY

The analysis shows the following:

Danger Points.

1. Poor liquidity balance.
2. Unprotected reserve position.
3. Dangerous cash showing.
4. Too great investment in fixed assets for total stockholders' investment.
6. Too heavy inventory showing.
7. Vitality of unit of money investment is too small.
8. Striking example of a poor balance between money supplied business by stockholders and that by creditors.
9. Sales do not warrant plant investment, and, considered with No. 4, show that the organization is overextended.
10. Profits are one-half the minimum return that would reflect a healthy return.

Normal Point.

5. A good collectivity showing.

The above analysis shows that the management will have a number of difficult problems on its hands in bringing this business back into proper balance.

It is very important for the manager of any business enterprise to know the normal values which each of the above ratios should have, for the particular business which he is managing. These ratios are not constant for all businesses, that is, a ratio which indicates a normal and healthy condition in one business, is wholly inadequate for another business. Therefore, these ratios are not to be considered as absolute measures, but *indicators* which, together with other factors, show the general status of the business. The peculiar significance of these ratios is as follows:

The ratio of Current Assets to Current Liabilities is generally considered to be an indicator of the ability of the company to pay its current debts promptly. In passing judgment on this ratio in any given case, care must be exercised on the following matters. Since Current Assets are made up principally of Cash, Accounts Receivable, and Inventory, it can readily be seen that a company having Current Assets largely in cash is in a far different position than one having Current Assets mainly in inventory of raw material in great excess of current requirements, although both companies may have the same ratio.

It is also evident that a company having receivables which are long past due cannot be said to have a Current Asset which is readily converted into cash. Therefore, the ratio by itself is not a conclusive indicator of a company's current position. Weight must be given to the nature and size of the inventory and to the state of the Accounts Receivable. In general, a ratio of Current Assets to Current Liabilities of 250 per cent is satis-

factory, provided the Accounts Receivable do not represent more than 30 days business, and the inventory is well balanced and appropriate to current sales demands.

The ratio of Reserves to Total Assets is not a particularly significant ratio without some information regarding the peculiar hazards of the business.

In general, a reserve item is a withdrawal from the surplus account in anticipation of an expenditure which events indicate may have to be met. Reserves may be set up in anticipation of the renewal of equipment. Such a reserve is known as a "depreciation reserve." Reserves may be set up for bad debts. In times of depression, this reserve should be larger than in normal times.

If a company is threatened with a civil suit on account of alleged patent infringement, a reserve should be set up immediately in anticipation of this event. If a company is engaged in manufacturing a product, of which the art is very active, that is, many inventions are constantly being made in this field, it may be necessary to set aside a reserve for the purchase of patents or for research to develop new products, or improve the present product.

Any number of circumstances, therefore, may demand the establishment of a reserve. Since dividends are payable from surplus only, the real significance of a reserve is to prevent the taking of money out of the business in greater amounts than the future needs of the business in the matter of contingent demands for funds may warrant.

There is a very important matter, in connection with

setting up reserves, which is very frequently overlooked, and that is that when a reserve is set up it becomes in effect a lien against cash and, therefore, the cash item should bear some relation to the reserve. Suppose, for example, that a reserve of $250,000 is set up in anticipation of an expenditure and it should arise that this expenditure must be made. If cash on hand is only $40,000, and just sufficient for current requirements, it is evident that the situation can only be met by bank borrowings or the negotiation of a loan.

Now, this does not imply that cash on hand must always equal the amount of the reserves, plus current needs, but what is required is that the amount and nature of the reserves should have some bearing on the amount of cash on hand. A reserve should always be supported by adequate cash. Just what amount is adequate will depend on the probability of having to meet the situation for which the reserve was created.

In general, a reserve is set up to protect the Total Assets, but the ratio which should obtain in any given case cannot be definitely established.

The ratio of Cash to Current Liabilities, which establishes the cash position of a company, is generally considered satisfactory if it is about 25 per cent. This assumes that the business is not seasonal. If a large quantity of merchandise or material is purchased for conversion into salable products, to be marketed at a distant date, it will be evident that cash income will be deferred and, therefore, a ratio of 25 per cent may not be adequate, because bills must be met before money is received from the sale of the product. Such situations

must be analyzed and set up in the form of a budget of income and expenses, before one may be assured that adequate cash is provided to meet current bills.

The ratio of Total Assets to Net Worth is an indicator of the extent to which the stockholders own the business. From one standpoint it is good business to borrow money at 7 per cent and use it in a business at a profit of 20 per cent. The difficulty in the situation is, that the creditors from whom money is borrowed are generally secured by instruments which permit them to take drastic measures in case of a default in payment of interest on loans, or the payment of the loan at maturity. It is because of this hazard, by which creditors claims may become pressing and embarrassing, that it is not well to have too large a proportion of the capital in the business supplied through such sources.

Now, the question in any given business is, how much is too large a proportion? The answer is that there is no general rule but that the situation should be carefully guarded.

The ratio of Receivables to Sales measures the care with which credit has been extended and the diligence of the officer responsible for collections. It is current business practice to pay all bills within 30 days. A discount for payment within 10 days is usually allowed. Incidentally, it may be noted that the allowance of such discounts is generally an expensive method of collecting accounts.

If a company has more than 30-day business in its Accounts Receivable, it is generally a sign of weakness in the credit and collection departments. This, how-

ever, is not always the case. Sometimes it is necessary to extend long credits. In the sale of fertilizer to southern farmers, the material is delivered in the spring and planters' notes are given for payment when the cotton is ginned in the fall. If the cotton crop is not good, the notes are not paid in full. In the automobile business it was soon found prohibitive to extend long credits, because it required altogether too much working capital, so credit or finance corporations were formed to handle the purchasers' notes. However, one of the great economic problems facing us is the direction of credit to production channels and the restriction of credit to those who are inclined to live beyond their incomes. It is so easy to buy goods on the installment plan and finance purchases through discount houses, that the people in general are mortgaging their earnings too far in advance. There is consequently a false stimulus to business, which is sure to have a bad reaction. For a business which deals with a wide market, the ratio of receivables to annual sales should not be greater than about 10 per cent, but for businesses which deal with a seasonal market, there is generally a tendency to extend credit and the ratio may be higher and yet conform with good business practice. However, it is not to be forgotten that the longer the credit the greater the hazard.

The ratio of the Inventory to Sales is, to some extent, a measure of a company's purchasing and production policies. Inventory, it will be recalled, is made up of raw materials, work in process, and finished goods. The time of converting raw materials into finished products, the availability of raw materials throughout the year,

are important factors in passing judgment on this ratio. The inventory required by a foundry making gray iron castings from pig iron, which may be purchased any day, is quite different than the inventory required by a manufacturer of industrial alcohol from molasses, which is purchased when the crop is available.

A shirt manufacturer will begin the production of shirts in June for delivery in the fall, and for which he has previously purchased his materials, or at least made his commitments. It may take 2 months to make an engineer's level, but a loaf of bread is baked in a day. Therefore, the inventory requirements in respect of work in process are quite different in these two industries.

A large inventory of sugar in a rising market is quite different from a large inventory in a falling market. The ratio of inventory to sales, therefore, must be judged on the basis of the requirements of the business, and the characteristic features of both the buying and the selling markets in which the business functions.

The ratio of Annual Sales to Net Worth measures the activity of the money which the stockholders have at the risk of the business. In general, the higher the ratio, the better the investment. The ratio is preferably greater than 200 per cent, because lower ratios are generally indicative of a hazard to the margin of profit. When the ratio is high, it indicates that the business has some " slack," that is, there can be a drop in sales without the same consequence to profits, as when the ratio is low.

The ratio of Debt to Net Worth shows the relative

interests of stockholders and creditors. This should be low for reasons referred to above.

The ratio of Sales to Fixed Assets indicates the vitality of the Fixed Assets. It is also a measure of a wide or a narrow range of sales at a profit. If the ratio is high, it generally indicates that there are low fixed charges on the business, and therefore the break-even point (see Fig. 8, Company B) is low, with a consequent wide range of sales at a profit. A low ratio, on the other hand, shows a high fixed charge and a narrow range of sales at which a profit can be made. A business with a low ratio is more liable to get into trouble during a period of depression than is a business having a high ratio.

The ratio of Profit or Loss to the Capitalization is, of course, a very important factor, for, in the final analysis, a business is measured by the amount of profit that is made. It does not disclose hazards, however, and therefore is not useful in determining the tendencies of the business.

When profits arise from several sources, it may be helpful to determine this ratio for each source, in order to learn the extent to which each product or source of income contributes to the profits of the business as a whole.

Referring to the above ratios — in general it may be stated that it is always helpful to compare similar ratios for a series of Balance Sheets to determine the tendencies of the business, for although a given set of ratios may seem favorable for a given Balance Sheet, if they are tending in a wrong direction, there is something wrong with the business which demands correction.

It is helpful to realize that an analysis of the above nature is generally made by the banker whenever a company is negotiating for a loan, particularly if the bank has not had much experience with the borrower. Accordingly it is helpful if the borrower should make such an analysis himself and supply such explanations as the results of the analysis may warrant.

CHAPTER VII

MEASURING THE RESULT OF OPERATIONS

CHAPTER VII

MEASURING THE RESULTS OF OPERATIONS

The Profit and Loss Statement

A FINANCIAL STATEMENT of the results of conducting a business for a given period of time (usually 1 month or 1 year) is generally termed the Profit and Loss Statement. A simple form of such statement is as follows:

Profit and Loss Statement
A. B. Manufacturing Company
New York City

January 31, 1930

Sales		$857,393.22
Allowances		1,116.40
Net Sales		$856,276.82
Cost of Sales:		
Labor	$242,986.10	
Material	157,321.16	
Factory Expense	209,110.09	
	$609,417.35	
Gross Profit		$246,859.47

Administrative Expense	$ 24,732.07	
Selling Expense	76,117.22	
		100,849.29
Operating Profit		$146,010.18
Other Income		216.14
		$146,226.32
Other Expenditures		1,513.20
Net Profit		$144,713.12

The items of the operating statement or Profit and Loss Statement are to be interpreted as follows.

Sales means actual billings to customers for goods shipped during the month. Sales are not orders, that is, an order does not become a sale until goods are shipped and billed to the customer. Thus a company may have received $1,256,520.16 of orders during the month, but if it has only shipped $971,250.16 during the month, the sales are the latter amount.

Allowances are deductions from billed price to customers on account of discounts taken on prompt payments. There may also be other reasons for allowances.

Net Sales, then, represents the actual sum of money which may be expected to be received for goods sold.

Cost of sales is a term current in accounting practice and means the factory cost of the goods sold (see pages 48 to 50).

Labor means the direct-labor cost of the goods.

Material means the direct-material cost of the goods.

Factory expense means that portion of the cost of

possessing and operating the factory which is properly chargeable to the goods sold.

Gross profit is the difference between net sales and factory cost and is the profit realized before administrative and sales expenses have been deducted.

Administrative expense and *Sales expense* are the parts of the *general expense* of the business.

Operating profit is that profit which is realized from the operations of the business proper and exclusive of subsidiary operations from which arise other income and other expenditures.

Net profit is that sum which is added to the surplus of the business and as such is available for dividends and other corporate purposes.

An analysis of the operating statement giving the several items of the statement in terms of percentage of net sales is very helpful in disclosing important relationship. The above statement analyzed on this basis gives the following results:

		Percentage
Net Sales	$856,276.82	100
Cost of Sales	609,417.35	71.1
Labor	242,986.10	28.3
Material	157,321.16	18.3
Factory Expense	209,110.09	24.5
Gross Profit	246,859.47	28.9
Administrative Expense	24,732.07	2.8
Selling Expense	76,117.22	8.9
Operating Profit	146,010.18	17.2
Net Profit	144,713.12	16.9

The results of operating a business are sometimes shown in graphic form as the " sales dollar." The above results shown in this manner are given in Fig. 18.

The above graph indicates that for every dollar of income received during the period of operation to which these data relate, labor (direct labor) received 28.3 cents, material (direct material) was purchased for 18.3 cents, the factory operations absorbed $24\frac{1}{2}$ cents, the sales department spent 8.9 cents, the administrative offices spent 2.8 cents, other income and other expenditures taken together absorbed 0.3 cents, and there was left to the owners of the business 16.9 cents.

Particular attention is called to the fact that the expenditures and profit just indicated are only those which obtain for a given volume of sales and for a given plant output and by no means should any such percentages or ratios be taken as constant for the business to which they relate. A great error will be made in forecasting the probable earnings of the business if it is assumed that the net profits on all sales will be 16.9 per cent, or that the factory expense is always 87 per cent on wages, as the above data show to be the case only for a given volume of business done. The reasons underlying these assertions are set forth on page 105.

Every engineer knows that in the operation of a group of machines they should not all be treated alike. Some need one sort of care and others require a different kind of attention. A steam turbine, for example, must be run with a comparatively high vacuum on the condenser to obtain a maximum economy in steam consumption. A reciprocating steam engine may not be so materially af-

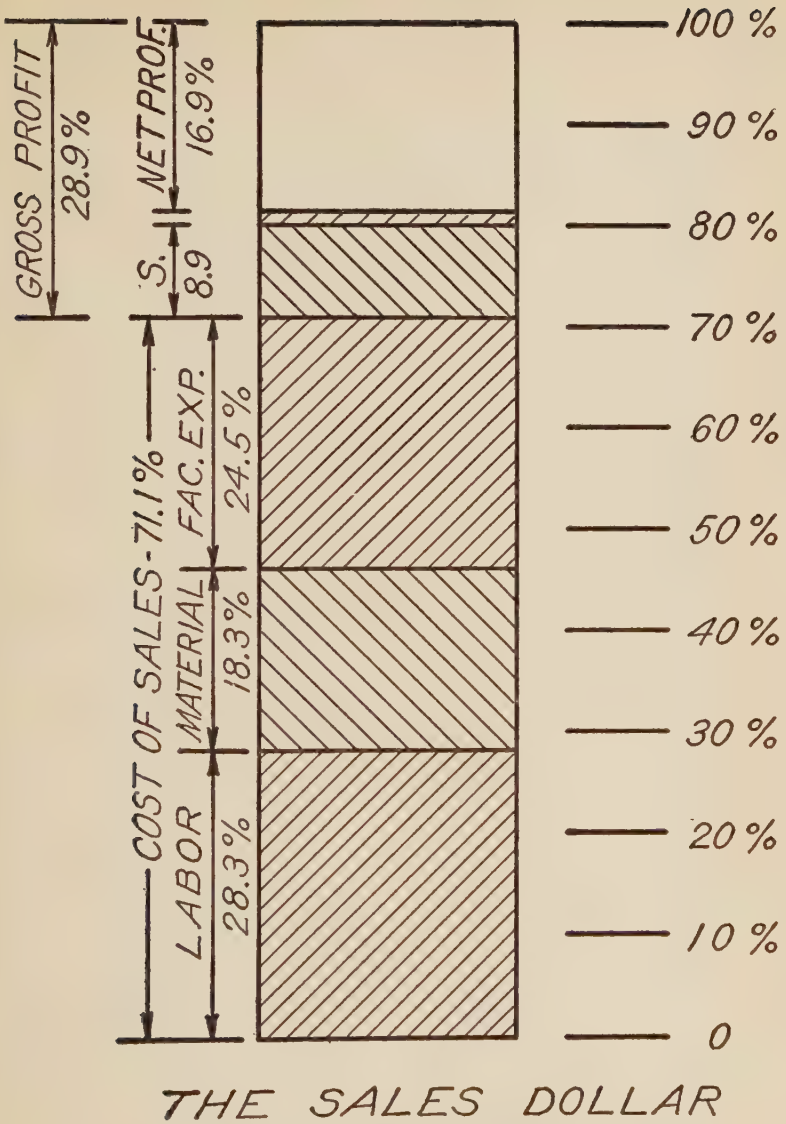

FIG. 18. THE SALES DOLLAR

fected by vacuum conditions as a turbine. A uniflow engine may be operated over a wide range of loads with little change in steam economy, while another type of engine must run near its rated capacity, for any loading above or below its rated capacity will result in material increase in steam consumption. The electrical engineer knows that it is not desirable to apply a 10-horsepower motor to operate a 2-horsepower load, because the current consumption is too great. The factory manager, however, does not always realize that it is very costly to permit a $1 per hour mechanic to go to the tool crib to procure a set of needed tools when the same work could be done by unskilled labor at 35 cents per hour, without stopping the operation of a productive machine.

Every business has certain characteristics of operation which should be fully understood if they are to be completely controlled. Some of these characteristics are revealed by the operating statement. The above statement shows the following interesting facts:

1. The manufacturing division of the business occasions the greatest amount of expense.

2. The most fertile field in which to attempt to effect economies is in the production of the product.

3. The selling division of the business is not very costly to operate and therefore if all departments of the business are well balanced, and the plant is running to capacity, there is not much effort to be put in effecting economies in selling, if expenses have to be reduced for one reason or another.

4. In general, the margin of profit in this business is

largely controlled by efficient factory methods and, therefore, this business needs the very best type of factory superintendent.

It is always well to bear in mind that the margin between success and failure is generally very narrow. Any errors in judgment on the part of the sales department in pricing goods, or in other ways, added to errors in judgment in purchasing materials at unfavorable prices, plus errors in judgment in determining methods of processing, in addition to errors in judgment in setting piece rates in the factory, etc., etc., may, through their cumulative effect, completely wipe out an otherwise good margin of profit.

The situation is saved in many cases through the operation of the law of probability which provides that all mistakes are not liable to happen at the same time. On the other hand, it is equally true that the law of average provides that *some* of these mistakes continually occurring prevent a 15 per cent profit from becoming a 20 per cent profit. It does not always follow that because a business may make a profit of 15 per cent, for example, and everybody is satisfied because the business has never been any more profitable, that it could not be made to earn a 20 per cent, or even a 25 per cent, profit if it were better managed. Unfortunately, rational methods for measuring the maximum earning capacity of a given business are not generally employed and, therefore, there are no definite standards by which the management of a business may be accurately judged.

The Profit and Loss Statement for any period may be forecast by the ordinate and its subdivisions, in the break-even chart, corresponding to the sales for the period. Thus the Profit and Loss Statement (with the detailed items grouped differently) for the industry represented by the break-even chart of Fig. 15 when the sales are at 75 per cent plant capacity will approximate the ordinate at that point. When sales are at 100 per cent plant capacity the Profit and Loss Statement will approximate the results shown by the ordinate at the extreme right-hand edge of the chart.

Measuring Operations in Terms of the Unit Man Employed at Direct Labor

It is difficult to visualize the trends of a business by the use of the Profit and Loss Statement alone, that is, the Profit and Loss Statement does not disclose some facts important to acquiring a broad and comprehensive view of operating conditions. The Profit and Loss Statement attempts to disclose what the business has accomplished in a period, in terms of money value. The Balance Sheet shows its status at any time in terms of money value.

Practical operating men, however, must look at a business from the standpoint of what is going on in the various divisions of the business in order that *accomplishment* (profit) and *status* (balance sheet) may be satisfactory.

The characteristic nature of industrial enterprises may also be measured from the standpoint of the in-

vestments and services required to keep a productive employee at work, and by the volume of salable goods he produces in a given time. Some years ago (1920), the writer devised a unit of measurement and relationships relating to the above facts which has been of some service in comparing the performances of given industries from time to time, and in comparing one industry with another.

This method is suggested by the following general observations.

A workman in a certain factory receives a given annual wage per year. The company produces a given quantity of goods, which it sells for a given sum of money. A given quantity of material is consumed in manufacturing the goods. A certain amount of service is rendered to the direct-labor employees during the year at a given cost. The total plant investment is a given amount. The company employs a certain number of productive or direct-labor employees. The quantity of goods produced varies with the number of direct-labor employees at work.

In another company, all these quantities are different. Therefore, one company will differ from another in the value of goods produced per productive employee, and the costs of serving each productive employee as well as the capital invested to permit his being employed.

Furthermore, the characteristics of a business may be easily visualized in terms of the productive employee. Workmen do not differ much from each other, and therefore, the amount of work accomplished by each under similar conditions will be quite uniform.

The question now arises — what is a proper and satisfactory unit of measurement and what are the significant factors to be measured? Will the number of direct laborers employed during the year be a satisfactory unit? No, because all of the direct laborers have not been employed all of the time during the year. Will the average number do? No, because the average does not mean anything. Apparently, a unit must be devised which is representative of a man being continuously employed throughout the year at direct labor. If a man were continuously employed in the average industry, he would work 48 hours per week for 50 weeks in the year, allowing 2 weeks vacation and time out. This represents 2,400 productive hours which, fortunately, is a convenient number of 200 productive hours per month. Since statements of account are balanced monthly and annually in most businesses, these numbers may be conveniently used to represent the monthly or annual status of the business in terms of the unit productive man. Every manufacturing enterprise of any consequence keeps a record of direct labor or productive hours available on a weekly basis, so this unit of measurement can be easily applied. If, for example, the number of productive labor hours paid for, in a given industry, is 225,000 for a certain month, it may be stated that there were 1,125 unit men employed during the month. The payroll may show 1,230 direct-labor employees at work during the month, but an examination of each name may show that 40 of them worked only 2 weeks, 50 for 10 days, and a number were out part time because of illness and other causes.

Monthly comparisons are useful in measuring conditions in any given business. Because of seasonal vacations, the annual basis is the better for comparing one business with another.

The conditions to be measured will vary with different enterprises because some factors are more important in one business than they may be in another. In general, however, the following factors or relationships are useful:

1. Wages per unit man per month.
2. Materials cost per unit man per month.
3. Factory expense per unit man per month.
4. Administration expense per unit man per month.
5. Selling expense per unit man per month.
6. Sales value produced per unit man per month.
7. Profit per unit man per month.
8. Number of unit service employees [1] per unit man per month and:

   a. Fixed capital per unit man.
   b. Working capital per unit man.
   c. Inventory value per unit man.

In those industries where the workmen are supervising processes, the factory workers may be taken all together as the basis for determining the number of unit men employed and the office and field workers may constitute the service employees.

[1] A unit service employee is 200 indirect-labor hours per month, which hours include those of salaried employees who are not paid on an hourly basis.

Suppose these values are given or these ratios are expressed. What good are they? — What can be done about it? The answer is — nothing — unless it is also known what these values should be, and what is to be done to bring them up to standard.

All measurements are comparative. If there is no standard of comparison there can be no measurement in the true sense of that term.

Performance and the state of things may be compared with other performances and states of things, and we find that one is more or less than the other. But how much do they vary from what they should be — that is the question. The " what should be " is the standard.

A salesman once sought the writer's approval because he had increased sales 100 per cent in a territory in which he had recently been installed. By his standards (past records) he did well. His standards, however, were wrong for the territory had a much greater potentiality — he should have done three times the amount of business he did. His standards were too low.

As a general rule it is very difficult to determine at the outset the maximum standard of accomplishment and the minimum costs required in each department of a business over a given period of time.

Attempts to measure performance in terms of the unit productive man are best made on the basis of present conditions and by a continued study of operating conditions to gradually bring about improvement and strive for higher standards.

But it is essential, if a business is to be brought up to

its highest state of efficiency, to have standards of accomplishment which are possible of attainment.

Let us take a current operating report and put it in a form to show the characteristics of the business or the bases of the unit productive man.

A given business, manufacturing and marketing a machine-shop product, shows the following performance for the month (round numbers used).

Sales		$187,500
Labor	$ 15,625	
Material	100,000	
Factory Expense	25,000	
Total Cost of Sales		140,625
Gross Profit		$ 46,875
Administrative Expense	2,250	
Selling Expense	10,000	
Total General Expense		12,250
Operating Profit		$ 34,625

Operating records show that there were:

1. 25,000 direct-labor hours.
2. 15,000 indirect-labor hours.

Let a unit productive man be represented by 200 hours. Accordingly the 25,000 direct-labor hours will represent the equivalent of 125 men continuously employed during the month at direct labor.

This record shows that for every man (unit man) employed during the month there were produced and sold

goods to the value of $1,500 and that it cost to maintain this man

Wages for Labor	$125.00
Materials for Product	800.00
Factory Expense	200.00
Administrative Expense	18.00
Selling Expense	80.00
Total	$1,223.00

For every dollar paid the man in wages, the company supplied him with $6.40 of material to work upon and furnished him with services to the amount of $2.38.

The indirect-labor record shows that every group of five men employed at direct labor had three men to serve them in various capacities. The Balance Sheet of the company shows an investment in fixed assets of $500,000. Therefore the company invested $4,000 for each man employed at direct labor. The company makes a profit of $277 per month on each productive man.

The value of such an analysis is based on the proposition that the quantity of goods produced and sold during a given period of time by any company will depend upon the number of men employed at direct labor engaged in producing the goods. The profits will depend on how much it costs to keep the man at work both in wages paid and services rendered to help him do the work and to get the orders for him to work on.

The following form of report is suggested for its convenience in displaying current conditions with previous

conditions of operations. It is more convenient to the accounting department to prepare these reports monthly but a weekly report is more helpful in many cases and can be prepared if certain approximations are made of those costs which can only be determined monthly.

MONTHLY REPORT ON OPERATIONS
PER UNIT MAN

Item	Current	Average year to date	Average total last year
Orders Shipped.....			
Wages Paid.....			
Materials Used.....			
Factory Expense.....			
Administration Expense			
Selling Expense.....			
Gross Profit.....			
Operating Profit.....			
Service Employees.....			
Fixed Capital.....			
Working Capital.....			
Inventory Value.....			

If the company is operated on a budget basis it is convenient to add a fourth column for insertion of the budget figures for each of these items.

Each division of the business may be analyzed in the same manner as the business as a whole and each division manager will then have a method of measurement to guide him.

The value of ratios such as the above in comparing one industry with another is at once apparent.

Modifications and subdivisions of the above ratios as

required for any particular business will immediately suggest themselves when a study of that business is undertaken. The important problem is finding the principal indications of business trend and establishing simple, convenient methods of getting the facts about them.

In the current issue (March, 1929) of *Mechanical Engineering,* the monthly journal published by the American Society of Mechanical Engineers, L. P. Alford, in collaboration with J. E. Hannum has suggested the use of the kilo-man hour (1,000 man-hours) as a basis of measurement of manufacturing operations. The writer has found it more convenient to use the unit man representing 200 productive hours per month or 2,400 productive hours per year, for the reason that this unit may be used more effectively with the monthly financial figures and with annual statements. It is also believed that it is easier to think in terms of what a productive man continuously employed can accomplish in a month or a year, and what the costs of maintaining such a unit man are in a month or a year.

CHAPTER VIII

THE BUDGET

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THE BUDGET

THE BUDGET of a business is a forecast of probable sales over a period of time — frequently for the year — together with a detailed statement of the probable expenditures of manufacturing and merchandizing the product. Budgets are based on records of past performance and estimates of the future requirements. An important factor in making the budget is the market forecast. One may ask, If the budget is based on a " guess," wherein lies its value? The answer is that the budget, though based on a forecast of market probabilities, shows the relation of sales to costs and, therefore, discloses the probable operation of the business at varying volumes of sales.

If sales do not come up to expectations, a measure is had of probable costs at reduced sales and attention is directed to these items which have the greatest influence on cost. An expense item that is watched, somehow seems to stay within bounds and frequently grows smaller.

There are many people who spend the company's money and each has different ideas as to needs, economies, and results to be accomplished by expenditures. Some spend without thought. The budget provides a means for the management definitely to express itself

on how expenditures are to be made and thus establishes the means for executive control of funds.

There are several ways in which a budget may be prepared, but the writer has devised and used a method which seems to have met with some favor. This method is based upon the preparation of a graphic analysis of the economic characteristics of the business as disclosed in Chap. V. Such an analysis shows the relation of costs to volume of business done and, therefore, is a proper basis for determining the total amount in details of costs for a specific volume of sale anticipated.

The difficulties encountered in the preparation of the budget for a particular business will depend upon the nature of the business. If, for example, the business is one of manufacturing automotive parts for automobile manufacturers, the forecast of probable sales in any one year or in a portion thereof is quite difficult for the reason that the automobile manufacturer is in the habit of asking for deliveries in unexpected amounts and upon short notice. He also is liable to cancel further shipments as his own production program is altered. Such conditions demand an understanding of the variations in costs with volume of sales even more than in those businesses which have a more uniform sales demand.

Some businesses require the carrying of large inventories in advance of sales, such, for example, as the fertilizer industry, and the shirt-manufacturing industry, while with other industries, such as bread and perishable food products, no large inventories either of raw materials or finished goods are carried. The budget of

cash requirements must in each instance be based on the relation between time of purchase of materials, time of manufacture, sales of finished products, and collection of Accounts Receivable.

The vast majority of businesses, however, do not have sudden fluctuations in sales. There may be seasonal demands but these can readily be anticipated from the experiences of the past.

We will endeavor to set forth the different steps to be taken in preparing the budget for a typical business and to establish those principles of procedure which are fundamental thereto.

1. *Analysis of the Operating Statement.* — The first step to be taken in preparing the budget of a business is to examine the operating statement and its supporting details and divide the items of cost into *constant total costs* and *variable total costs.* Constant total costs are those costs which are fixed regardless of the volume of business done, such, for example, as taxes, insurance (except employees' liability insurance), depreciation, salaries of permanent employees, rent, etc. Variable total costs are those costs which vary with the volume of business done, such, for example, as wages of workmen, materials consumed, freight and expenses, a portion of power expense, etc.

We will choose, for example, the operating statement of a business concerned with the manufacture and distribution of a food product. The annual operating statement for the business for the year 1924 was as follows:

FOOD COMPANY

Profit and Loss Statement January 1 to December 31, 1924

Sales:	
"Principal Product"	$2,529,098.04
By-product A	13,848.62
By-product B	11,807.38
Total Sales	$2,554,754.04
Manufacturing and Distributing Cost:	
Manufacturing Cost	$1,054,177.32
Freight and Express	198,549.48
Branch Operations	604,921.32
Division Expenses	140,280.00
Total	$1,997,928.12
Gross Profit:	$ 556,825.92
Administrative and Selling Expense:	
Administrative Expense	$ 141,612.10
General Selling Expense	85,307.90
Total	$ 226,920.00
Profit from Operations	$ 329,905.92
Other Income:	
Discount Earned	$ 2,412.60
Interest from Bank Accounts	3,887.40
Total	$ 6,300.00

Deduction from Income:		
Interest on Mortgages	$	3,762.00
Idle Plant Expense		22,842.00
Total	$	26,604.00
Net Profit	$	309,601.92

A detailed examination of each item of manufacturing cost showed which items were constant, which varied with the rate of product, and which were dual in character. The sum of these items which were constant was $474,533, or 45 per cent, while the variable items amounted to the total of $579,644, or 55 per cent.

An examination of the items of Freight and Express showed that this was totally variable. An analysis of Branch Operation costs showed that $520,300, or 86 per cent, was constant and $84,621, or 14 per cent, was variable. Division Expenses were found to be constant in character. Both Administrative and General Selling expenses were also found to be predominantly constant in character.

Accordingly, therefore, the divisions of expense entering into the determination of Profit from Operations were of the following natures:

Items	Total	Constant	Variable
Manufacturing Cost	$1,054,177	$474,533	$579,644
Freight and Express	198,549	.....	198,549
Branch Operating	604,921	520,300	84,621
Division Expense	140,280	140,280	
Administration Expense	141,612	141,612	
General Selling Expense	85,307	85,307	
Total	$2,224,846	$1,362,032	$862,814

It is estimated that the business when operating to full capacity can accomplish annual sales of $3,500,000 at the same unit prices, accordingly, the business is being run at $\frac{2,554}{3,500}$ = 73 per cent capacity. These data may now be used to construct the " break-even " chart of business. This is accomplished as shown in Fig. 19.

2. *Construction of the Break-Even Chart.* — Lay out the base of the chart Fig. 19 in terms of percentage of plant capacity and the vertical scale to the unit of $100,000 as shown at the point of 73 per cent plant capacity. Erect the ordinate *AB* to a height to scale of $1,362,032 and draw the horizontal line *CD*. Locate the point *E* above *B* at a distance of $862,814 to scale, which is at a distance of $2,224,846 to scale above *A*, and construct the line *CE*, extending it to the right-hand edge of the chart. Locate the point *F* above *A* at a distance of $2,554,754 (annual sales) to scale and construct the line *OF*, extending it to the right-hand edge of the chart. The constant portions of the manufacturing cost and of the other divisions of the business may be drawn in as shown. The business is found to break even at annual sales of $2,040,000, or at 58½ per cent plant capacity. The business may be conducted at a profit when sales are over $2,040,000 annually and the specific amount of profit to be expected will be found between the total-costs line beyond the 58½ per cent capacity point. For example, should sales be at 90 per cent capacity, which is 90 per cent of 3,500,000, or $3,150,000 annually, the profits to be expected may be found by erecting an ordinate at the 90 per cent point and reading that por-

tion of the ordinate between x and y, which to scale is $710,000.

3. *Preparation of the Monthly Profit and Loss Budget.* — When a business has seasonal fluctuations and many businesses are subject to such influences, it is instructive and helpful in measuring the results accomplished each month, to prepare a statement of anticipated monthly sales and anticipated costs thereof. This is accomplished as follows:

Prepare a table of past sales by months from the sales record of the previous year and from a detailed study of sales tendencies in each territory, determine the probable sales for each month for the ensuing year. The results when tabulated will appear as shown in the accompanying table.

SALES BUDGET

Month	Past year, 1925	Coming year, 1926
January	$209,000	$220,000
February	197,000	210,000
March	205,000	225,000
April	200,000	215,000
May	213,000	235,000
June	200,000	220,000
July	210,000	240,000
August	211,000	245,000
September	215,000	255,000
October	231,000	280,000
November	221,000	280,000
December	242,000	290,000
Total	$2,554,000	$2,875,000

Next prepare a break-even chart for monthly sales in the same manner as the chart (Fig. 19) was prepared

on the basis of annual sales. Thus, from the data given on page 201, it will appear that for average monthly sales or production of $\frac{\$2,554,754}{12} = \$212,900$, the variable and constant costs will be as given in the following table:

Item	Constant costs	Variable costs
Manufacturing Cost	$39,500	$48,300
Freight and Express	.....	16,500
Branch Operation	43,400	7,000
Division Expense	11,650	
Administration Expense	11,750	
General Selling Expense	7,100	
Total	$113,400	$71,800

The break-even chart from these data will appear as given in Fig. 20. In order to obtain more accurate readings, only that portion of the chart relating to the profit area need be constructed. Thus, at 100 per cent plant capacity, the monthly sales are $292,000 and at 50 per cent plant capacity the monthly sales are $146,000. The corresponding monthly costs are $212,000 and $163,000. If the ordinates for the chart are between $120,000 and $300,000, this range of sales will be covered. The chart is therefore laid out with ordinates from 12 to 30 to the scale of one division equals $10,000, and with the base from 50 to 100 per cent plant capacity. Net profits for the month for any given sales are found by locating the sales point on the vertical scale at the

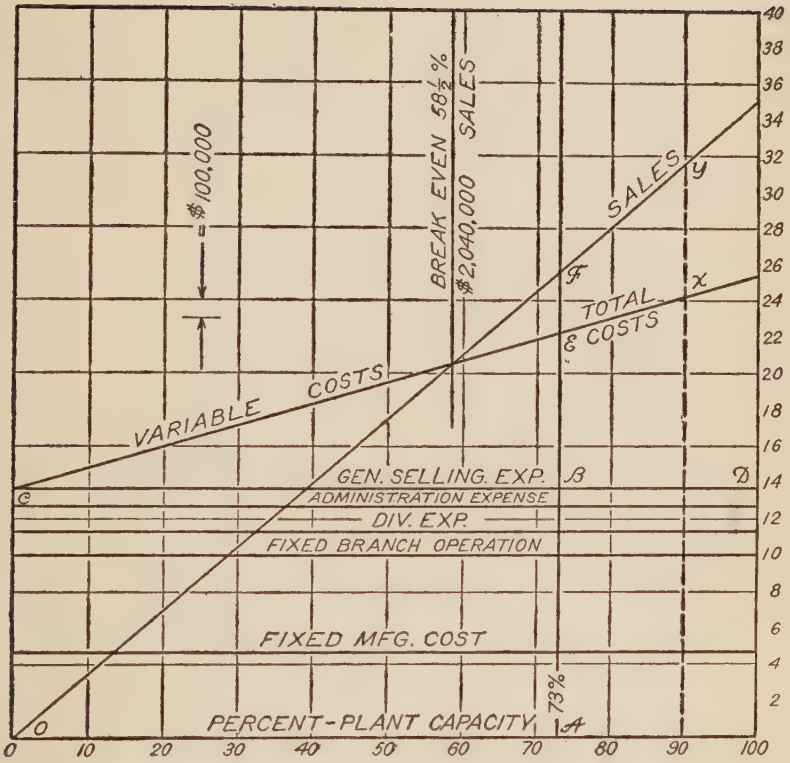

FIG. 19. THE BREAK-EVEN CHART APPLIED TO BUDGET ANALYSIS

right of the chart, projecting a horizontal line to intersect the sales line, dropping a vertical line from this point to the cost line. Thus the sales for January are estimated to be $220,000, from which it is determined that the profits should be in the neighborhood of $32,000. Determining net profits for each month in succession in the above manner, there will result the following Net Profits budget.

NET PROFITS BUDGET

Month	Anticipated sales	Anticipated profits
January	$220,000	$32,000
February	210,000	25,000
March	225,000	35,000
April	215,000	28,000
May	235,000	42,000
June	220,000	32,000
July	240,000	45,000
August	245,000	48,000
September	255,000	55,000
October	280,000	72,000
November	280,000	72,000
December	290,000	78,500
Total	$2,875,000	$564,500

4. *Preparation of the Expense Budget.* — It is evident that the detailed costs corresponding to any given sales during any month may be found from the break-even chart in the same manner as net profits were estimated. It is well to note that the expenses or costs thus found do not necessarily imply cash expenditures for the month. The sales and expense budgets may be, and

generally are, different than the revenue and expenditures or the cash budgets. Revenue or cash received will lag behind sales by from 30 to 45 days, depending upon the credit policy of the company, and cash disbursed will depend on how promptly the company pays its bills. Expenditures for production may be heavy in any one month because of large production in anticipation of future deliveries, while costs or expenses for the sales of the corresponding month may be less because the sales are less than the production. In some food-production industries, sale and production are nearly equal each month and, therefore, the expense or cost of production may be approximately determined by the use of the break-even chart from the sales for the month.

When such determinations have been made, the results may be expressed in tabular or graphic form.

Figure 21 shows the actual sales and expenses by months and for the year in comparison with the budget, for an industry supervised by the writer. It will be noted that the short light lines above the heavy line represent the monthly performances, while the heavy lines represent the cumulative results for the year. The budgeted sales and expenses are represented in each instance by the lengths of the open rectangles to scale. The scale of expenses other than of production is reduced from the scale of sales in order that the lines may be seen more clearly.

5. *The Cash Budget.* — An estimate of cash receipts and cash disbursements by months for the year constitutes the cash budget. Cash receipts arise from sales,

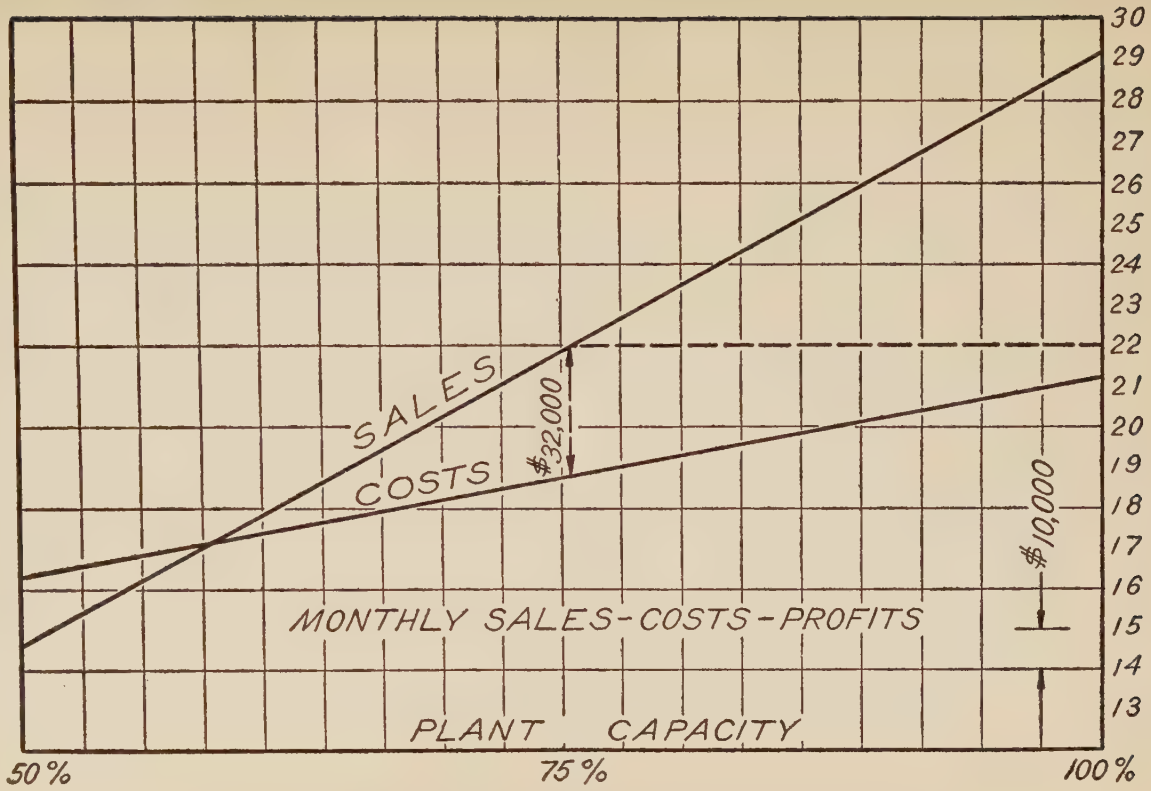

FIG. 20. A SECTION OF THE BREAK-EVEN CHART APPLIED TO BUDGETING OPERATIONS

discount earned, interest earned, and other sources. As mentioned before, receipts from sales will lag behind sales by approximately 30 days. The cash receipts in relation to sales for the several months may be readily anticipated from the books of account. In preparing the budget of disbursement, it is necessary to do two things: *first,* determine from the accounting records, those expenditures such as insurance, taxes, fixed salaries, legal expenses, etc., which can readily be anticipated in the accounting office; *second,* have each department head submit an estimate, preferably on a standard form supplied for the purpose, of the ordinary and extraordinary expenditures proposed for the coming year. These should be given by amounts and times of payment required. In asking department heads for proposals for the budget, it is essential that the general manager, from his forecast of the general situation, advise the department heads of certain limits allowed for expenditures. After all proposals are in, a conference with each department head is generally desirable before final adoption of the proposals. These proposals, as amended and finally adopted, are the basis for preparing the cash budget as shown in Table IV. This table is given for a 6-month period because of space limitations. All receipts are set down by months, next all disbursements relating to business operations, and next all capital expenditures to be made during the year. From these data the cash position anticipated at the end of each month is determined, as shown at the bottom of the table.

6. *Department Budgets.* — The proposals referred to in the preceding paragraph are also formulated as de-

partment budgets and constitute the appropriations authorized for the operation of each department. When these appropriations on budgets are mimeographed for the monthly period, they form the basis of monthly reports to the general manager, and show actual against estimated expenditures. In Table V is given a budget report from the sales department of a business and in Table VI is given the budget report from the purchasing department of a business. A typical office budget and report is given in Table VII. These monthly reports are very helpful in controlling the operations of the business.

Any business which is operated on the budget basis is more readily controlled than one which is not operated in this manner. The charts and tabulated statements above referred to constitute the indicators of the business. What could a plant engineer do without instruments consisting of meters and gauges to guide him in the operations of the plant? The science which has been applied to engineering operations can also be applied to business operations. When the economic characteristics of a business are known, it can be controlled so that financial strains in any part of the business may be avoided. Any business may be more safely guided through a period of depression and financial stress when its characteristics are understood and may be operated for greater profits in normal times.

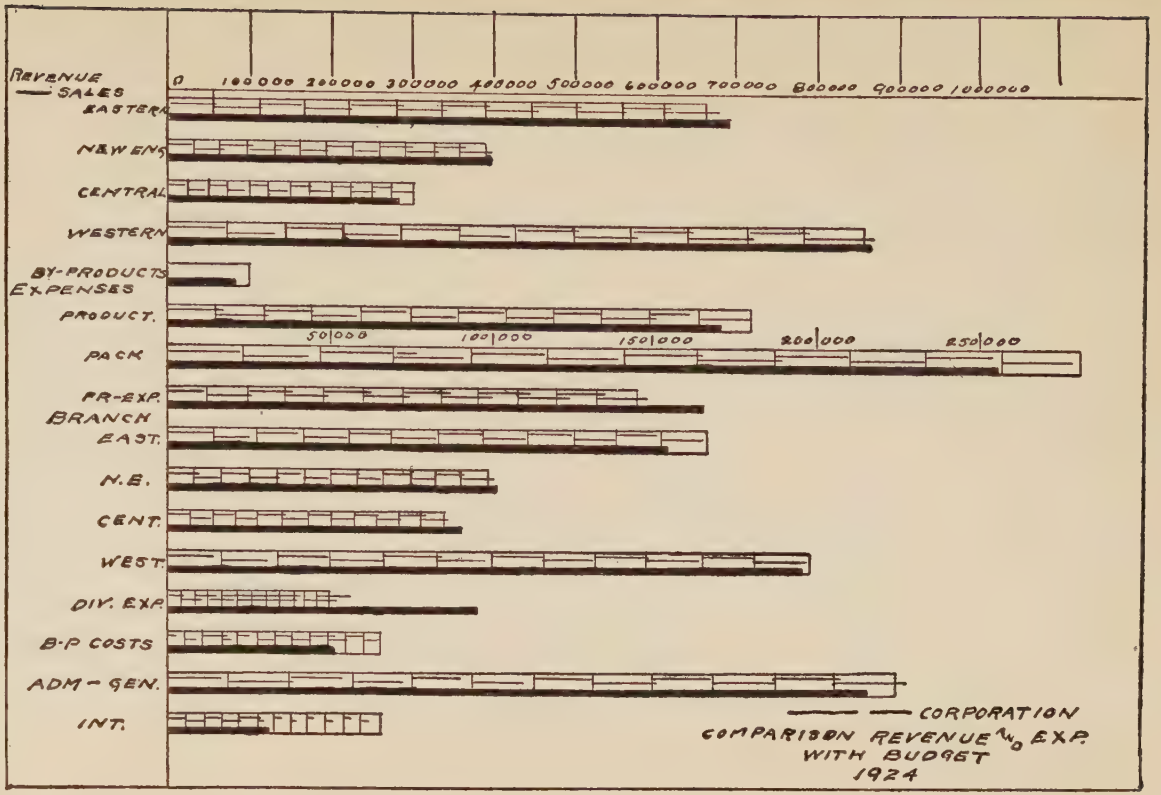

FIG. 21. A GRAPHIC COMPARISON OF REVENUE AND EXPENSES WITH THE BUDGET

TABLE IV — (THE NATIONAL) FOOD COMPANY

Estimate of Cash Receipts and Disbursements for January to June, 1924.

	January	February	March	April	May	June	Total
Receipts:							
"Principal Product"	$205,000	$200,000	$210,000	$190,000	$195,000	$200,000	$1,200,000
By-product A	2,000	2,000	2,000	2,000	2,000	2,000	12,000
By-product B	400	400	400	400	400	400	2,400
Cash Discounts	200	200	200	200	200	200	1,200
Bank Interest	300	300	300	300	300	300	1,800
Total Receipts	$207,900	$202,900	$212,900	$192,900	$197,900	$202,900	$1,217,400
Disbursements:							
A. Expenses:							
"Raw Materials"	$ 28,000	$ 14,000	.....	.....	.....	.....	$ 42,000
Insurance	149	2,675	.....	$ 548	$ 10,843	$ 1,566	15,780
Taxes	174	1,068	$ 2,737	422	5,240	265	9,906
Plant Repairs	6,300	5,750	6,400	6,050	5,900	5,300	35,700
Autos Traded In	3,600	2,925	3,375	2,475	3,825	4,500	20,700
Sales Promotion	3,050	3,050	3,800	1,850	1,850	2,850	16,450
Branch Salaries	28,000	28,000	28,600	28,700	29,200	29,200	171,700
Fluctuating Expenses	57,802	55,778	57,224	55,778	59,249	56,356	342,187
Fixed Expenses	63,183	63,183	63,183	63,183	63,183	63,183	379,098
Legal Expenses	2,000	2,000	.....	.....	1,000	1,000	6,000
Total	$192,258	$178,429	$165,319	$159,006	$180,290	$164,220	$1,039,522
B. Other Disbursements:							
Capital Plant A	.....	$ 5,000	$ 5,000	$ 5,000	$ 5,000	.....	$ 20,000
Capital Plant B	$ 3,000	.....	.....	.....	.....	.....	3,000
Capital Plant C	1,450	1,700	8,700	4,700	2,200	.....	18,750
Capital Plant D	3,500	.....	.....	600	.....	.....	4,100
Capital Plant E	4,000	.....	.....	.....	.....	.....	4,000
Capital Furniture and Fixtures	200	200	200	200	200	$ 200	1,200
Capital Refrigeration	.....	.....	1,000	.....	.....	3,000	4,000
Capital Autos	.....	350	.....	350	.....	350	1,050
Idle Plant Costs	950	950	950	950	340	340	4,480
Sprinkler-Plant A	.....	6,750	.....	.....	.....	.....	6,750
Mortgage Due	250	250	250	1,250	250	250	2,500
Mortgage Interest	314	314	314	314	314	314	1,884
Total	13,664	15,514	16,414	13,364	8,304	4,454	71,714
Total All Disbursements	205,922	193,943	181,733	172,370	188,594	168,674	$1,111,236
Cash First of Month	180,000	181,978	190,935	222,102	242,632	251,938	
Add Receipts	207,900	202,900	212,900	192,900	197,900	202,900	
	387,900	384,878	403,835	415,002	440,532	454,838	
Deduct Disbursements	205,922	193,943	181,733	172,370	188,594	168,674	
Cash on Hand End of Month	$181,978	$190,935	$222,102	$242,632	$251,938	$286,164	

Report No. 1.

TABLE V. — 1924 BUDGET MONTHLY REPORT OF SALES DEPARTMENT
For Month Ending August 31, 1924

	Monthly appropriation			This month's record			Explanation or comment
	Sales in pounds	Average price, cents	Cost of distribution	Sales in pounds	Average price, cents	Cost of distribution	
Eastern Division...	272,900[1] 273,000	19.1	$12,827.00	287,597	18.8[2]	$13,079 01[2]	
New England Division.....	158,900[1] 159,000	20.6	8,194.00	152 859[2]	20.7	8,713 23[2]	
Central Division...	136,900[1] 137,000	21.0	8 125.00	134,260[2]	19 9[2]	8,217 35[2]	
Western Division...	330,900[1] 331,000	21.7	16,617.00	332,120	21.6[2]	16,637 59[2]	
Total.....	899,600[1] 900,000	20.6	45,763.00	906,836	20.3[2]	46,647 18[2]	

Selling Expenses	Monthly appropriation	Yearly appropriation to date	This month's expenses	Expenses this year to date
Salaries	$ 4,555 00	$ 36,440.	$ 5,633 67[2]	$ 39,693 78[2]
Traveling Expenses	1,250 00	10,000.	2,863 26[2]	19,858 74[2]
Advertising	870 00	6,960.	1,085 87[2]	7,529 49[2]
Sales Promotion	2,070 00	16,560.	2,089 09[2]	16,901 78[2]
Bad Debts — Plant Sales	223 00	1,784.	217 66	1,869 69[2]
Subscriptions and Donations	80 00	640.	55 50	799 25[2]
Trade Expenses	65 00	520.	39 70	269 40
Auto Renewals	50 00	400.	16 92	522 25[2]
Telephone and Telegraph ...	110 00	880.	198 01[2]	1,485 00[2]
Stationery and Supplies	85 00	680.	111 11[2]	927 32[2]
Miscellaneous	25 00	200.	71 30[2]	1,174 06[2]
Rent, Light, and Heat	....	.....	214 50	1,749 50
Sales Contract Expenses	....	.....	27 00	161 63
Branch Bonuses	....	.....	667 61	3,813 46
Main, of Display Material ...	....	.....	235 72	1,192 45
Total	$ 9,383 00	$ 75,064.	13,526 92[2]	97,947 80[2]
Total Selling Expenses and Branch Operations	$55,146 00	$441,168.	$60,174 10[2]	$459,411 91[2]

[1] Estimated Seasonal Quota.
[2] Over the Budget.

Report No. 9.

TABLE VI — 1924 Budget Monthly Report of Purchasing Department

For Month Ending October 31, 1924

Plant Materials	Price in cents per pound	Monthly appropriation value	Yearly appropriation to date	Expenditures				Explanation or comment
				This price, cents	Month amount	This year to date		
Raw Materials:								
Beet Molasses....	1.186	$ 9,477.64	$ 94,766.40	1.316	$13,145 87	$ 53,779 57		
Malt.....	2.393	4,972.95	49,729.50	2.691	7,047 92	44,911 63		
Malt Sprouts.....	2.298	2,371.65	23,716.50	1.665	1,875 39	9,469 57		
Corn.....	1.430	2,762.27	27,622.70	1.949	4,669 37	27,120 26		
Rye.....	1.339	19.61	196.10	.....	....	....		
Aqua Ammonia..	5.250	1,303.58	13,035.80	4.75	2,090 00	11,606 00		
Ammonia Phosphate.....	12.374	1,802.86	18,028.60	.....	....	12,891 13		Use of cane
Ammonia Sulphate	3.710	772.34	7,723.40	3.14	2,626 89	7,973 27		molasses
Starch.....	3.388	3,083.08	30,830.80	3.89	1,633 80	12,178 21		discon-
Cane Molasses...	1.090	.....	12,157.40	.....	....	7,661 65		tinued
Total.....		$26,565.98	$277,817.20		$33,089 20	$187,591 29		
Operating Supplies.....		$ 2,530.23	25,302.30		1,999 54	15,006 88		
Packing Supplies.....		4,747.00	47,470.00	.....	5,246 52	42,206 49		
Coal for Baltimore $5.25 per ton.....		2,651.25	26,512.50	4.20	898 59	11,165 93		
Coal for Pekin $2.80 per ton.....		2,548.00	25,480.00	2.67	940 38	16,219 50		
Total Plant Materials..		$39,042.46	$402,582.00	.....	$42,174 23	$272,190 09		
Other Purchases:								
Electric Power of Plants..		5,765.00	57,650.00	.....	5,648 75	57,147 39		
Gas and Oil for Branches.		3,346.00	33,460.00	.....	2,792 13	31,277 38		
Automobile Renewals....		2,823.33	28,233.30	.....	537 43	15,668 67		
Total Major Purchases		$50,976.79	$521,925.30	.....	$51,152 54	$376,283 53		

Remarks

Report No. 11.

TABLE VII. — Budget Monthly Report of Taxes, Insurance, and Office Expenses

For Month Ending February 29, 1924

	Appropriated		Expended		Explanation or comment
	For month	This year to date	For month	This year to date	
Taxes	$ 2,673.02	$ 2,860.07	[1] $910.68	$ 1,096.62	
Insurance	1,996.04	2,977.44	[2] 824.31	1,984.97	
Office Expenses:					
New York — Office Salaries	2,810.00	5,620.00	2,818.00	5,477.00	
Rent, Light, and Heat	510.00	1,020.00	632.69	1,112.22	Includes ninth floor
Stationery and Office Supplies	452.00	904.00	631.64	1,310.93	Better than January
Telephone and Telegraph	130.00	260.00	96.00	126.51	
Bank Collection Charges	40.00	80.00	19.00	59.46	
Corporation Tax	21.00	42.00	20.83	41.66	
Bonding of Employees	40.00	80.00	40.00	80.00	
Carfare and Sundry	35.00	70.00	140.11	214.80	Mostly suppers
Fire and Robbery Insurance	9.00	18.00	13.38	26.76	Includes tank car insurance
Chicago—Office Salaries	1,025.00	2,050.00	1,104.50	2,227.30	
Rent, Light, and Heat	125.00	250.00	235.16	394.10	
Stationery and Office Supplies	110.00	220.00	34.72	164.22	
Telephone and Telegraph	40.00	80.00	20.08	60.17	
Boston — Office Salaries	340.00	680.00	.....	.....	Original budget provided for branch office at Cambridge
Rent, Light, and Heat	85.00	170.00	165.00	230.00	
Telephone and Telegraph	20.00	40.00	.....	.....	
	$10,461.06	$17,421.51	$7,706.10	$14,606.72	

[1] We figured on paying Baltimore property taxes in February. These, however, will not come through until March. February taxes would have been $346.69 higher if the Baltimore property taxes had been paid that month, as we have now assumed the Baltimore real estate taxes, formerly charged to the Standard Distilling and Distributing Corporation.

[2] Some of the insurance invoices payable in February will not come through until March. Extra budget items paid in February were for steam-cooker insurance at plants amounting to $114.89.

CHAPTER IX

THE FUTURE

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THE FUTURE

ANY BUSINESS which demands the whole attention of the chief executive for its daily operations is destined to failure. Why? Simply because business is not the practice of an art which has been learned. The important business of the chief executive is to find out what the economic wants of *tomorrow* will be and to prepare to supply those wants at a profit. The wants of the future cannot be discovered unless somebody does some real constructive thinking about them, and the chief thinker of the business should be the chief executive.

Dressing Up the Business

A party of surveyors was once overtaken by the night in a remote section of Arkansas and asked hostage at a nearby farmhouse. After a rather uncomfortable night spent in improvised sleeping quarters, the break of day with the prospects of a hot country breakfast was most welcome. Breakfast was served in the kitchen and was all that could be desired except for the millions of flies that swarmed the place. Presently a line of ducks came marching along the kitchen path and advanced through a jagged hole in the screen door and began pecking the flies which had settled along the lower walls. This

strange and amusing sight called for some explanation by the hostess who said in complete despair, " I can't understand — we got so many flies — an' we got screens, too."

When high-speed steels were introduced some years ago, the writer recalls many instances in which the management purchased these steels for use in the shops and failed to understand why the machining time was not automatically reduced. The presence of high-speed steel in the tool room does not mean that it is being intelligently used in the shops.

Some years ago there was a plague of efficiency engineers who afflicted industry with cost systems, drew organization charts in squares and circles, with red lines and blue lines, and in other ways dressed up a business in real Sunday clothes. Yet the management could not understand why they still had losses when they had all these modern improvements.

Commendable as many attempts to modernize business were, many failed to accomplish all that was desired simply because they did not get at the root of the real problems to be solved. They put on a coating which made the business appear to be modern, when it was not. All that happened was that many things were more efficiently done which did not need to be done at all, and the things which should have been done were never introduced into the business.

Of course, it is necessary to have a proper cost system adapted to the needs of the business and to have a well-defined organization, but these will not make profits when the fundamentals of the business are unsound.

No Place to Go

The future success of a business does not depend so much on its present state as upon its dynamic principles and policies. Of course, an empty bag cannot stand upright, nor can a business reach any future state unless its present finances and credits will provide the strength to reach the goal. But so much time and thought are often given to the present status by the chief executive that conditions which must inevitably be met in the future are not discerned, and therefore not provided for.

A certain large telephone company recently engaged a competent analyst of scientific training to study the probable demands for communication between and to aeroplanes and dirigibles which would be likely to arise in the next 10 years. The continuation of this policy will result in this company's dominating the field. When the chief executive is wholly busy with the routine problems of the day, there is likely to come a day when there are no problems to be solved.

Most of our large companies are heading toward a definite goal and are giving serious thought to the problems of tomorrow. Perhaps that is one reason why they are large companies. But our smaller companies — those employing a few hundred men and less — unfortunately, are content to live day by day on the inertia of a good will built up on past efforts. It is a dangerous thing for some businesses to be prosperous. The ease and comfort and feeling of self-satisfaction

which come from large profits of the present often dull the senses and tend to make one unmindful of the future. Style changes gradually creep in and life habits change before it is realized that they are the cause of falling orders. The company has not kept abreast with the times and other more alert minds have taken the business. The company may be all dressed up but there is no place to go.

The Practicableness of the Impractical

In the Metropolitan Museum of Art, in New York City, there is found the work of a certain famous artist which may be referred to quite profitably in connection with our problem. This artist was engaged by certain wealthy patrons to perpetuate their likenesses in bas-relief. As one examines these sculptures, a pleasing harmony of line and form is noticed, the result of the inherent skill of the artist. But as we proceed we suddenly are struck with a beautiful likeness of a child — it is the child of the artist. What a warmth of charm — the simplicity of the child is shown in almost lifelike form. The artist has poured his soul into this work and the result is a masterpiece.

A few days ago the writer had occasion to confer with a chemist in the employ of a great manufacturing company, founded and headed by a famous industrialist. After our problem had been disposed of, the writer inquired concerning the head of the company. The chemist replied with a warmth of feeling which evidenced a real love for his chief, " He is quite well. I am seeing

him tomorrow and will bear him your greetings. Isn't he a wonderful man? "

Everybody in the organization has the same spirit, and the wonderful success of the business is in no small measure due to the great personality at its head. This man is a shrewd, capable business man and nobody can "put anything over" on him, for he has fought and won many battles in the courts of law, but with it all there is that honesty and ruggedness of character which endear him to every member of his organization and which inspire them to work with a zeal and singleness of purpose which is so productive of results.

How different the atmosphere is in the organization headed by the cold, hard-boiled executive — the small and intensely practical man. As my friend Mr. Fred Shibley describes him, "He sits aloft with knowing look." Our psychologist friends tell us that the assumption of such attitudes and masks are "defense reactions," conditioned by a sense of inferiority and of incompetence. Such personalities must build such walls around themselves in self-defense. The leadership of such men may force things done by fear but what real creative effort ever arises from such an environment? It is the duty of the chief executive to call forth the creative faculties of his associates. He is constantly dealing with emotional conditions; and such inspiring leadership can only arise from a great personality.

What relation does this topic bear to our main thesis about the future of any business? It bears a very important relationship because it relates to the vitalizing

force which underlies the effectiveness of any plans or policies which may be adopted concerning the future welfare of the enterprise. It deals with the oft neglected impractical matters which sometimes become the most practical of all.

What Can Be Done About It?

The important problems in operating any business, aside from those of pressing immediate importance, are: Where will the business be in 5 years from now? In 10 years from now? What ought it to be? What is the possibility of its becoming? What should be done to shape it toward this objective? The extent, range, and difficulty of these problems will vary and be different for each particular business. There are, however, a few general principles of procedure which are applicable to the solution of these problems, no matter what may be the particular nature of the enterprise.

The first principle is: No rational conclusions can be drawn from opinions, guesses, ancient beliefs, and superstitions, but only from facts.

The second principle is: the facts of a business when properly correlated and interpreted show relationships and trends which indicate the inherent nature and possibilities of the business.

The third principle is: When analysis of the business indicates that the possibilities of the enterprise are declining, it should be immediately changed by the introduction of new products, by conversion to other uses, or be liquidated.

The fourth principle is: if the business has future possibilities they may be realized according to the law:

$$S = \frac{C}{P}$$

where

S = success.
C = competence of the organization.
P = purpose.

If the organization is 100 per cent competent and there is a singleness of purpose, then the success of the enterprise is:

$$S = \frac{100 \text{ per cent}}{1} = 100 \text{ per cent}$$

If the organization is 50 per cent competent and there is a dual purpose (so much for the business and so much for me), then the success will be:

$$S = \frac{50 \text{ per cent}}{2} = 25 \text{ per cent}$$

The application of these four principles to a diagnosis of the future of any business will be stimulating, helpful, and profitable.

The First Principle

One of the greatest hindrances to progress is the ready acceptance of *opinions* concerning things, whereas only a little initiative is necessary to discover real facts.

Aristotle enunciated the proposition that if a light ball and a heavy ball of the same size were dropped from a height, the heavier ball would reach the ground first; and because it was announced by Aristotle it was accepted and taught as a fact for 2,000 years — just think of it — 2,000 years! Galileo, twenty centuries later, said, "Let's try it." So he proceeded to the tower of Pisa and dropped two balls, one heavy and one light, and they both reached the ground at the same time. Aristotle was wrong. But the tragedy of it all was that it took 2,000 years before anyone had sense enough to prove it. Now these stupid people were our ancestors; therefore we may have inherited tendencies of which we must be very alert or we may revert to type.

The first important question which arises in this adventure is what *kinds* of facts are important facts for the particular business in hand? These are not always so easily discerned and it will be found that some kinds of facts are most important for some businesses and of very minor or negligible importance to others. The safest procedure, however, is to examine all possible situations which have any bearing on the business. The facts to be inquired into should be gleaned from three principal sources: facts about the product, facts about the market, facts about the organization.

Now facts are very peculiar; they are very shy and only appear on invitation — that is, the helpful kind do. Then there are the hard, cold facts that appear; like the proverbial wolf at the door, they come unannounced and are very menacing. Furthermore, it seems that when

the helpful kind have been around the hard, cold facts never appear.

Invitations to helpful facts are issued by the simple process of asking some real intelligent questions. Without attempting to give an exhaustive list, we might suggest that any forward-looking executive would ask himself a few questions like the following:

Questions About the Product

1. Why should anyone buy our product?
2. What complaints does the trade make about our product?
3. What suggestions for improvements of our products come from the field?
4. How do our competitors rate with us: How are they better, how not so good?
5. What amount of improvement have we contributed by research and development and how much have we copied from others?

Questions About the Market

1. Are we reaching all possible users of our product?
2. What new uses for our products are indicated by general market developments?
3. What new products are appearing in the market which are likely to be serious competitors in the future?
4. What general developments are taking place which may mean a decrease in the use of our products?
5. What lines of research should we keep in touch with?

Questions on the Organization

1. Is each department head the best man for the job, or has he learned a routine and is just nursing the job along?
2. How many department heads come to me with real problems?
3. Is the business run on the budget basis and does the budget mean anything?
4. Who in the organization is thinking about tomorrow's business?
5. Do things get all tangled up if I or any of my chief associates are absent for awhile?

One question leads to another and any serious attempt to find the real facts and the important facts by an inquiry as suggested above will stimulate any business.

Business failures do not grow in a soil that is continually stirred up by serious questions. Such ventilating action usually stimulates a healthy growth of productive ideas. But the answers to questions are not always correct answers. Figures are not always facts. Accordingly, much patient checking and rechecking are often required to verify the facts and to prevent the adoption of a course of action which may be unprofitable. We must also remember that what used to be a fact may not be one today. In this respect some facts are like eggs — they do not improve with age.

The Second Principle

If I should tell a freshman in college that the Federal Reserve Board was going to raise the rediscount rate 2 per cent, it would be a fact, but it would not have much meaning to the freshman. The same fact related to a Wall Street broker would be most important indeed, and would be the cause of his altering some contemplated plans. Why? Because, in the case of the freshman, this fact does not relate itself to any of his life experiences; to the broker it does. To the broker it means a tendency to liquidate securities and a possible bear market.

In the average business the important facts are really very few. It is related of a certain well-known oil magnate that he carried the important facts of the business in a little red notebook, carried in his hip pocket, which he used in preference to the elaborate statements prepared by the accountants. Did you ever stand on the bridge of an ocean liner and note the very few facts which were dealt with in guiding the vessel's course? But the oil magnate and the ship's captain knew the significance of the facts dealt with. It was not the facts alone, but their relation to future possibilities that were the important thing. And thus it is with any business enterprise. The economic characteristics of a business must be thoroughly understood through a proper correlation of facts before proper decisions may be made as to the future course of the business.

The Third Principle

It is not always easy, however, to make decisions which may change the course of a business. Precedent is a powerful influence. There is always the hope that things will be better in the future and the general tendency is to wait and see if business may not pick up. At that time the executive needs courage to stand alone. Nobody wants to share the responsibility of doing new things. There are always those who are willing to stand on the side line and be ready to look wise in case the boss stubs his toe. From childhood on, the human being always seeks the approval of the group. Sir Isaac Newton said that he announced the law of gravitation in his youth and spent the rest of his life defending it.

When the facts of a business indicate the need of a change, the business is passing through its most trying period and the chief executive is put to a real test.

The writer once noted a legend in the office of a business executive which may be appropriately referred to at this time. It read as follows: " Wisdom consists in knowing what to do next. Skill consists in knowing how to do it. Virtue consists in doing it." The successful practice of the third principle enunciated above seems to depend on " virtue," which results in doing it.

The Fourth Principal

Let us examine the success formula announced in connection with the fourth principle. To this end, let

us consider how a manufacturing organization may grow. John Jones makes a kiddie car for one of his children — it is just an idea he has to please the child. The neighbors' children see it and immediately each wants one, and so John Jones spends his evenings making kiddie cars. After awhile, the owner of a department store in town suggests that he could sell quite a number of these cars to the children of the town, and asks John Jones if he will make them for him. John Jones finds he has started a business. He is wise enough to protect himself by obtaining a patent and, giving up his clerkship at the mill, he spends all his time in a shop he has rigged up in his barn, making kiddie cars. After awhile he has more work to do than he can personally take care of; so he hires a man to help him. He tells this man, who is an experienced carpenter, "You saw the lumber and turn the pieces while I put the parts together and put on the finishing touches." After awhile he hires a painter to put on fancy figures and designs. A traveling salesman comes to town, and, seeing the possibilities of selling this novelty in other towns, proposes to John Jones that he take him on as a salesman. This is done, with the result that more men must be hired to make more cars. Soon John Jones finds he must have somebody to keep books, someone to write letters and collect accounts, and so on and so forth. Thus the business grows, because there arose specific things to be done and competent people were engaged to do them. There was a singleness of purpose and a competent organization.

Compare this, on the other hand, with the usual social

organization. Mr. Brown, socially inclined and having his emotions stirred by the plight of the poor families living in " Happy Hollow," calls a meeting of citizens, and after a passionate address proposes something be done about it. So they start an organization. Mrs. Smith, prominent socially, is elected president of the organization (she gives such delightful parties!). Mr. Babbitt is elected treasurer, and Mr. Green secretary. Committees are appointed so that no one is overlooked. Then somebody thinks they should give some card parties to raise money. This meets with general approval and a series of parties is held. This is followed by luncheons — maybe someone reads a paper on " The Social Question," and everyone has a good time. Now what is happening in the meantime to the poor people of " Happy Hollow? " Perhaps they have been forgotten entirely, or maybe the treasurer did send them what was left of the funds after the prizes for the card parties were paid for.

Now, wherein lies the difference in principle between these two types of organization? Why did one accomplish its purpose and the other not? It is admitted that there are some psychological questions involved in this analysis. The children demanded kiddie cars while the people of Happy Hollow did not demand help, and perhaps did not know they needed help. Laying these questions aside, however, it is to be noted that the kiddie-car organization had a very definite purpose — a single purpose — which was an economic gain through selling kiddie cars. Also, each man employed was engaged as a result of there being a specific thing to do and be-

cause he was qualified to do it. In the social organization, the purpose was complex. Some served because it helped them socially; others thought it would be good business to be on a committee with Mr. Brown, and so on. None were trained in social-service work, nor indeed knew that such training was required or could be had. Further comparisons seem hardly necessary for it must be quite obvious that these examples illustrate that the success of any organization is directly proportional to the competence of the organization and inversely proportional to the complexity of purpose of those who have charge of its principal functions.

In Conclusion

Races are usually run over a measured course and not by the distance traveled in a given time. Whatever the reason may be for establishing racing events on this basis, the results seem to be quite satisfactory. When I was a boy I used to watch with great interest the training of the famous race horse John R. Gentry, and was particularly impressed to note the operations of the pacemakers. The pacemakers, for some reason, made a lasting impression on my memory, of which I have often thought in later years.

Now business in many respects is like a race. It should be run over a measured course, and, given a good product and an efficient pacemaker, a good showing should be made if there is anything in the horse. If I should pick out any one principle to be followed, I would pick out the principle of the budget as the most

productive of all. Given a good product and an adequate backing (financial structure), any business can be vastly improved if its operations are budgeted and the results of actual performance regularly compared therewith. The budget principle is one of those fundamental principles which cannot be applied without a host of collateral benefits following from it. It is the great starting point for thinking about the future. It introduces the principle of cause and effect. It raises questions which do not otherwise arise. It is the start of placing the business on a scientific basis because it introduces the element of quantitative measurement which is the basis of all scientific procedure.

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